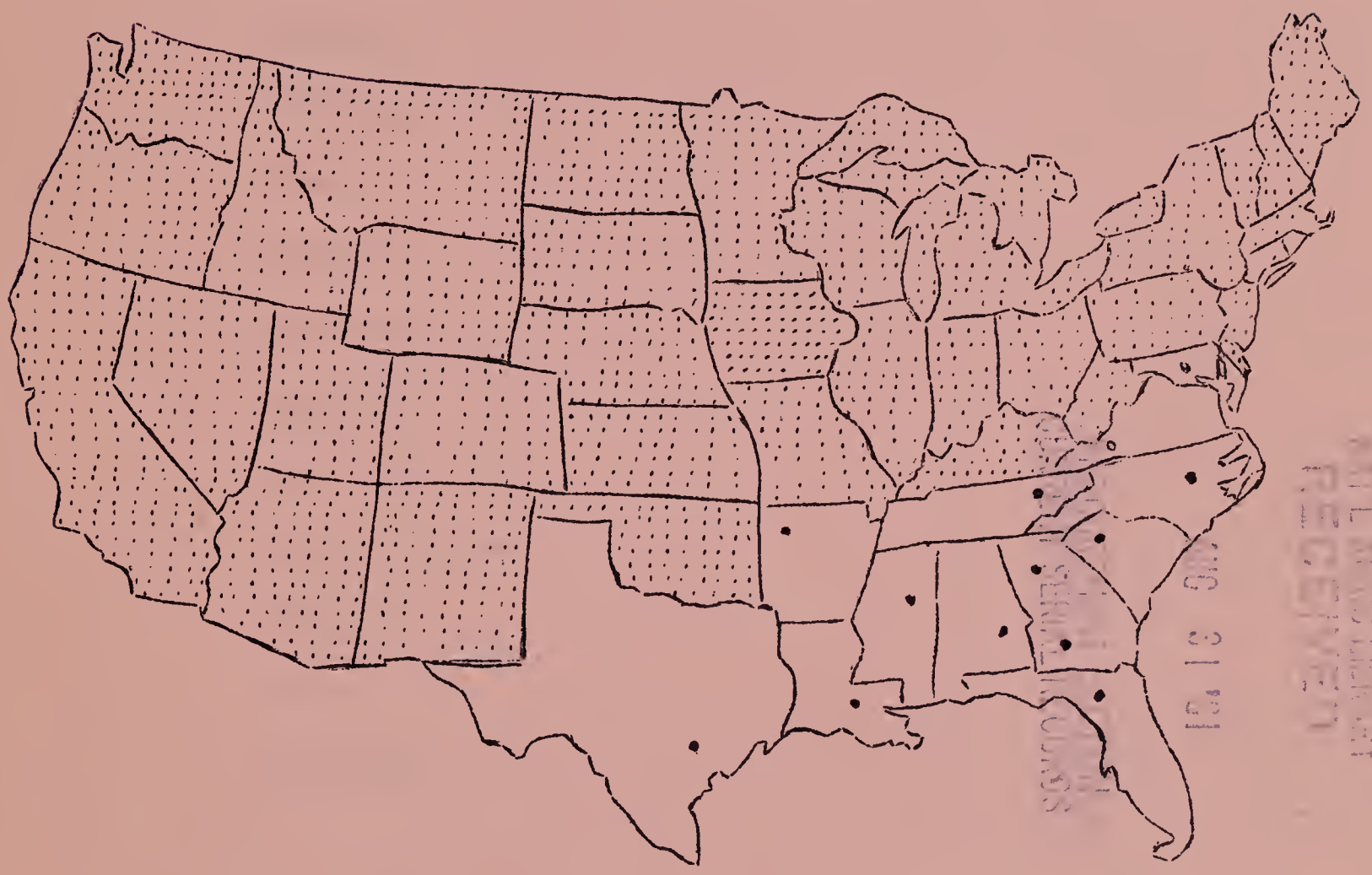
U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ANIMAL INDUSTRY
AND
COOPERATING SOUTHERN STATES

1951 Annual Report of S-10 IMPROVEMENT OF BEEF CATTLE FOR THE SOUTHERN REGION THROUGH BREEDING METHODS

January 1, 1952



This is a report submitted by project leaders of Project S-10 "Improvement of Beef Cattle for the Southern Region Through Breeding Methods", and compiled by the Regional Coordinator. It is intended for use of administrative leaders and workers in developing the project, and is not for general publication.

C O N T E N T S

INTRODUCTION

According to a revised project outline prepared during 1951, the objectives of the Southern Regional Beef Cattle Breeding Project are:

1. To study breeding systems, selection criteria and procedures, and to explore new ones, with the view of determining those most effective for the improvement of the productive capacity and market quality of beef cattle in the South.

2. To study productiveness of existing or introduced stocks of beef cattle.

Due to the fact that the scientific study of problems encountered in breeding more productive beef cattle under the varied soil and climatic conditions of the southern region of the United States is in its infancy, a number of different approaches are being made in this research project. The work of the project can be put in four general categories:

1. Development of measurement methods and selection criteria.

2. Assessment of the productive value of cattle from various sources and different breeds or types.

3. Comparisons of different breeding systems.

4. Estimating the heritability of characters of productive importance in beef cattle.

It will be obvious from the state reports that many animals contribute to two or more of these phases.

The work of the project during the year has progressed according to plans outlined in the 1950 Annual Report. There have been moderate increases in the number of breeding females at several stations due largely to natural increase. There has been a marked increase in the number of animals being fed out under standardized test conditions.

During the year the Alabama and Florida stations have added new personnel trained in animal breeding who will be associated with this project. The Louisiana and Texas stations have replaced resigned personnel with others of similar training.

The 1950 Annual Report set forth in some detail the history of the project, gave a more detailed discussion of the objectives than found here, and pointed out the major problems with which we are faced. These will not be considered in detail at the present time, but the reader is referred to the 1950 report.

The reports of the various stations engaged are found in the pages which follow.

PERSONNEL of the S-10 Project

STATE AGRICULTURAL EXPERIMENT STATION WORKERS
(asterisk indicates Tech. Committee Members)

Alabama	*Keith E. Gregory, W. D. Salmon	Auburn, Ala.
Arkansas	*Warren Gifford, C. J. Brown	Fayetteville, Ark.
Florida	*W. G. Kirk	Ona, Fla.
	Marvin Koger	Gainesville, Fla.
Georgia	*B. L. Southwell	Tifton, Ga.
	Walter Neville	Experiment, Ga.
Louisiana	*Richard A. Damon, Jr.	Baton Rouge, La.
Maryland	*J. E. Foster, W. W. Green	College Park, Md.
Mississippi	*T. B. Patterson	State College, Miss.
North Carolina	*H. A. Stewart, W. C. Godley	Raleigh, N. C.
South Carolina	*E. G. Godbey	Clemson, S. C.
Tennessee	*Charles S. Hobbs, H. J. Smith, R. P. Moorman	Knoxville, Tenn.
Texas	*Bruce L. Warwick	McGregor, Tex.
	R. E. Patterson, H. O. Kunkel	College Station, Tex.
	J. J. Bayles	Balmorhea, Tex.
	L. A. Maddox, Jr.	Panhandle, Tex.
Virginia	*C. M. Kincaid, R. E. Carter	Blacksburg, Va.
	B. M. Priode, Frank A. McClaugherty	Front Royal, Va.
	Roy Hammes	Middleburg, Va.

BUREAU OF ANIMAL INDUSTRY WORKERS

R. T. Clark, Nat'l Coordinator, Beef Cattle Research, Denver, Colo.
Everett J. Warwick, Regional Coordinator, S-10, Knoxville, Tenn.
A. L. Baker, Director, Beef Cattle Research Station, Front Royal, Va.
E. H. Vernon, Supt., Iberia Livestock Experiment Farm, Jeanerette, La.
William Jackson, Supt., Chinsegut Hill Sanctuary, Brooksville, Fla.
M. W. Hazen, Bluebonnet Farm, McGregor, Tex.

REGIONAL OFFICERS

R. E. Patterson, Administrative Advisor	College Station, Tex.
H. A. Stewart, Chairman	Raleigh, N.C.
B. L. Southwell, Secretary	Tifton, Ga.
Charles S. Hobbs, Executive Committee Member	Knoxville, Tenn.

ALABAMA STATION

Submitted by Keith E. Gregory, Dec. 17, 1951

1. Project Title: (Alab. 525) Improvement of Performance of Beef Cattle Through Mass Selection.

2. Objectives:

(a) To determine the effectiveness of mass selection for total performance in beef cattle.

(b) To develop criteria for evaluating and selecting breeding animals.

3. Accomplishments during year:

(a) Acquisition of cattle: Nineteen Hereford heifer calves and three Angus heifer calves were added to the project during 1951. This makes a total of 38 Hereford females and 22 Angus females in the project. One Hereford bull and one Angus bull were acquired during the year for use in the project.

(b) Improvement of facilities: An additional 100 acres was reclaimed and seeded to grazing crops during the year. This brings the total acreage, of the 975-acre unit, that has been reclaimed and seeded to approximately 250. A set of livestock scales, a hammer mill and a feed mixer were installed during the year. Feeding sheds for group feeding approximately 64 animals were added during the year and an adequate water system for the headquarters unit was installed.

4. Future Plans:

(a) Acquisition of cattle: It is planned to add approximately 15 Shorthorn females and one Shorthorn bull to the project in the immediate future. These will be used as foundation stock for a Shorthorn line.

(b) Improvement of facilities: Reclamation of land and seeding of grazing crops will be continued as rapidly as funds permit.

(c) Extension of project: As soon as adequate facilities are developed and an adequate number of cattle can be obtained, it is planned to determine the influence of heterosis on rate of gain, carcass quality and cow performance in beef cattle. The Angus, Hereford and Shorthorn breeds will be used in this study. As soon as funds and facilities can be obtained, a breeding project with laboratory animals is planned as a supplement to Regional Project S-10 to study methods of selection more extensively.

ARKANSAS STATION

Submitted by Warren Gifford and C. J. Brown, Dec. 28, 1951

Introduction

All animals in the Arkansas project are purebred, and are managed as such. Angus, Hereford, and Shorthorn cattle at the Main Experiment Station are managed as a single herd. A herd of purebred Angus is maintained at the Livestock and Forestry Station.

Hand mating is practiced, and calves are dropped in all months of the year with only a few being dropped during the summer. All calves are weaned at eight months of age. Bull and steer calves not used in progeny feeding trials are sold at weaning or shortly thereafter. All females are kept for replacements and after weaning are pastured or group fed to make acceptable growth. These heifer groups are made up according to age without regard to sire or breed.

1. Project Title: (B.J. 170) The Determination of Adequate Records of Performance Tests for Beef Cattle.

2. Objectives:

To develop practical but adequate methods for evaluating the breeding worth of beef sires and dams which would include the following:

(a) A system of measuring variations in young animals and the values of such measures in predicting variations in the same animals at more mature ages.

(b) Methods for measuring and evaluating the records of performance of brood cows.

(c) The determination of the kind of records and number of progeny necessary to prove beef sires.

3. Accomplishments during year:

(a) During the year from Nov. 1, 1950 to Dec. 1, 1951, the following cattle and facilities have been acquired for use in the Arkansas beef cattle breeding project:

One Hereford bull, WHR Helmsman 8th, was obtained for use as a herd sire on Hereford cows at the Main Experiment Station. One Aberdeen Angus bull was purchased for use as a herd sire at the Livestock and Forestry Station. Three Shorthorn, thirteen Hereford, and thirty Angus heifers were added to the herds from young heifers grown out as replacements.

At the Main Experiment Station, equipment acquired for use on this project includes a tractor and equipment for use in the development and maintenance of pastures used by the beef herd. Two sets of scales have been acquired.

At the Livestock and Forestry Station further development of a new and enlarged beef cattle area has been in progress. Corrals and working pens have been completed.

(b) The following research has been completed or is in progress:

Individual feeding of bull and steer progeny from two Hereford and three Angus sires have been completed. At present, individual feeding of two groups of bull progeny is in progress. Group feeding of heifers from four sires for a 90-day winter feeding period was completed.

Subjective evaluation studies of all animals in the herds were continued.

Growth and development changes in both young and mature animals, as indicated in weights and measurements, were recorded.

Milk production of twenty Aberdeen-Angus cows is being studied at present.

4. Future Plans:

Continuation of studies of milk production in beef cattle.

Continuation of growth and development studies on both young and mature cattle.

Continuation of subjective evaluation studies.

Continuation of individual feeding of bull progeny of sires with the feeding of steer and heifer groups when possible.

Continuation of the long time programs of developing lines within the herds.

5. Publications:

Gifford, Warren; C. J. Brown and M. L. Ray. A Study of Classification Scores of Hereford Cows. Jour. An. Sci. 10(2): 378-385, 1951.

Brown, C. J. The Influence of Age of Cow on her Conformation Scores. Jour. An. Sci. 10(4): 1022, 1951. (abstract)

6. Publications Planned:

Station Bulletin on subjective evaluation.

Station Bulletin on milk production.

Summary of progeny feeding trials.

POSTWEANING PERFORMANCE OF 1950 CALVES FULL FED AFTER WEANING

Arkansas Station

Line or group designation	A-3	H-2	A-7	A-8	H-3
Location	Main Sta.	Main Sta.	L & F Sta.	Main Sta.	Main Sta.
Breeding of calves	Angus	Here.	Angus	Angus	Here.
Av. inbreeding (%)	0	0	0	0	0
Bulls					
No.	5	4	5	5	5
Av. weaning wt.	544	596	471	451	500
Av. 12 month wt.	677	905	620	633	688
Length of feeding period	154	154	154	154	154
Feed per cwt. gain (lbs)					
Concentrates	492	576	626	601	521
Roughage	476	288	632	300	260
Av. daily gain on test	1.47	2.18	1.28	1.73	1.79
Av. type score (12 mo.)*	72	66	64	65	68
Steers					
No.		4			
Av. weaning wt.		569			
Av. 12 month wt.		781			
Length of feeding period		154			
Feed per cwt. gain (lbs)					
Concentrates		569			
Roughage		285			
Av. daily gain on test		1.88			
Av. type score (12 mo.)		64			

* On a scale with 100 being the top score.

INFLUENCE OF SIRE ON GAINS OF GROUP FED WEANLING HEIFERS OVER
90 DAY WINTER FEEDING PERIOD

Arkansas Station

Sire Group	H1	H2	A3	A4
No. Heifers:	7	2*	2	4
Av. wt. started (lb.)	545	390	629	454
Av. wt. ended (lb.)	623	484	719	517
Av. gain in wt.	78	94	90	63
Av. daily gain	.87	1.04	1.00	.70
F_x	20	0	0	0
Daily feed consumed:				
Grain - Ration no. 11**	4.75	4.75	4.75	4.75
Hay	ad.lib.	ad.lib.	ad.lib.	ad.lib.
Grain consumed per lb. gain	5.46	4.57	4.75	6.79

* One of these heifers was stunted. (orphan)

** Ration No. 11 consists of:
4 corn
2 oats
2 w. bran
2 CSM
T.D.N. 71%, D.P. 14%

PERFORMANCE OF COW HERDS. 1951 CALVES

Arkansas Station

L & F indicates Livestock and Forestry Station, Batesville
M. Sta. indicates Main Station, Fayetteville

Line or group designation	A-5	A-6	A-9	A-8	S-3	S-2	H-2	H-3	H-4
Location	M.Sta.	M.Sta.	M.Sta.	L.& F.	M.Sta.	M.Sta.	M.Sta.	M.Sta.	M.Sta.
Breed of sire	Angus	Angus	Angus	Angus	S'horn	S'horn	Here.	Here.	Here.
Breed of dam	Angus	Angus	Angus	Angus	S'horn	S'horn	Here.	Here.	Here.
No. cows bred	16	19	5	42	4	6	27	5	4
No. cows calving	16	19	5	33	4	6	27	5	3
No. calves raised	15	17	5	32	4	6	27	4	1
Av. inbr. dams (%)	1.2	2.8	0	0	0	0	0	0	0
Av. inbr. calves (%)	2.0	1.6	3.3	0	0	0	2.2	0	0
Av. birth wt. (lbs.)	60(15)	60(17)	59	55	59		69	57	60
Av. birth date	4-22-51	5-23-51	10-1-51	3-1-51	10-1-51	9-24-50	9-4-51	4-2-51	
Were calves creep fed?	Yes	Yes		Yes		Yes	Yes	Yes	
Av. wt. at 6 mon. (lbs.)	365(16)	373		337		362	480(13)	324	
Av. weaning date	12-22-51	1-23-52		11-1-51		5-24-51	5-4-51	12-2-51	
Av. wean. wt. (lbs.)	490(7)*	518(11)		425		460	542(10)	430	
Av. wean. type score**	69	73		68		62	68	69	
Av. wean condition score	69	74		65		60	68	68	

*Numbers in parenthesis indicate number of calf weights averaged. These are calves old enough to have records available when this report made in Dec. 1951.

**On a scale with 100 being the top score.

FLORIDA STATION

Submitted by W. G. Kirk, Dec. 31, 1951

From Range Cattle Experiment Station, Ona, Florida

1. Project Title: Breeding Beef Cattle for Adaptation to Florida.

2. Objectives:

To determine the value of different crosses and strains of beef cattle as foundation animals and for commercial beef production when kept under pasture programs designed to supply low, medium and good nutrition levels.

To determine the economic returns from improving nutrition level by use of improved pastures.

To obtain information on feed lot performance and carcass quality of steers of different breeding.

3. Accomplishments:

(a) The natural increase will provide additional animals for future use. The cattle available for this project include:

39 purebred Brahman females, cows and heifers
41 crossbred, Shorthorn-Brahman, cows and heifers
18 three-quarter Brahman and one-quarter Shorthorn, cows and heifers
2 three-quarter Shorthorn and one-quarter Brahman heifers
250 grade cows and heifers
9 purebred Brahman males, three mature and six calves
1 purebred Shorthorn bull
5 crossbred, Shorthorn-Brahman, bulls
2 three-quarter Brahman and one-quarter Shorthorn bulls

(b) Weight records have been obtained on all cattle at regular intervals during the year. Calves were scored according to slaughter, type and condition when weaned at approximately seven months of age. Breeding cows were scored in January 1950.

Slaughter data obtained on all cattle from experimental pastures and fattened in dry lot.

Maintenance practices have been improved resulting in greater thrift of the different breeding herds.

Percent calf crop ranged from 43 to 97 percent with an overall average of 83 percent.

4. Future Plans:

New project: Adaptability of cattle in Florida as influenced by breed composition and level of nutrition.

Florida Station (continued)

To obtain purebred Shorthorn bulls from U.S.D.A. Front Royal, Virginia, to be used in new project.

Improved coordination of the research program for the whole of Florida: Main Station, Gainesville, North Florida Station, Quincy, Everglades Station, Belle Glade, Range Cattle Station, Ona.

Analyzing growth data collected since 1942. (Graduate student from College of Agriculture, Gainesville, has already started on this work.)

5. Publications:

None in 1951.

6. Publications Planned:

(a) Meat studies of cattle fattened in dry lot.

(b) Growth rate of Florida cattle.

(c) Fattening cattle on citrus products.

POSTWEANING PERFORMANCE OF 1950 CALVES FULL FED AFTER WEANING

Florida Station

Line or group designation				
Location	Range Cattle Station, Ona, Florida			
Breeding of calves	3/4B 1/4Sh	3/4Sh 1/4B	P'bred Brah.	Crossbred Shorn-Brah.
Av. inbreeding (%)	--	--	--	--
Bulls, no. animals	2			
Av. weaning wt.	478			
Av. 12 month wt.	768			
Length of feeding period	120 da.			
Feed per cwt. gain (lbs)				
Concentrates	488			
Roughage	158			
Av. daily gain on test	2.54			
Av. type score (12 mo.)	11			
Steers, no. animals	3	2		6
Av. weaning wt.	473	423		466
Av. 12 month wt.	677	680 (1 steer 11 mo.)		725 (3-11 mo. old)
Length of feeding period	120 da.	120 da.		120 da.
Feed per cwt. gain (lbs)				
Concentrates	501	502		543
Roughage	201	222		204
Av. daily gain on test	2.03	1.79		2.01
Av. type score (12 mo.)	9	10		10
Heifers, no. animals			2	
Av. weaning wt.			488	
Av. 12 month wt.			705	
Length of feeding period			120 da.	
Feed per cwt. gain (lbs)				
Concentrates			564	
Roughage			214	
Av. daily gain on test			1.88	
Av. type score (12 mo.)			10	

PRODUCTION AND/OR SLAUGHTER DATA ON YEARLING AND OLDER CATTLE
NOT INCLUDED IN BREEDING HERDS IN 1951

Florida Station
Range Cattle Station, Ona

Line or group designation	Grade Brahman *	Crossbred Sh-Br.**
Breeding:		
Sex:	Steer	Steer
No.	12	8
Av. Age (fall 1950)	251 da.	20 mo.
Av. wt. (fall 1950)	446	823
Av. winter gain	99	-24
Days on pasture	--	202
Av. gain on pasture	--	190
Days on feed	129	76 (on pasture)
Av. wt. adjusted to 18 or 30 mon. of age	811	1118
Av. gain on feed	304	129 (on pasture)
Animals slaughtered:		
Av. age at slaughter	579 da.	30 mo.
Av. slaughter wt.	852	1118
Av. slaughter grade	10 (good)	10
Av. dressing percent	59.02 (cold)	57.23 (cold)
Av. carcass grade	10 (good)	10

* Grade Brahman Steers:
Fed in dry lot for 129 days, fed twice daily.

	Hay Pounds	Protein Feed Pounds	Citrus Pulp Pounds	Citrus Molasses Pounds
Feed per 100# gain	195	107	279	138

** Crossbred Steers:

Cottonseed pellets, 41% protein in addition to pasture

Pounds
131

PERFORMANCE OF COW HERDS. 1951 CALVES

Florida Station
Range Cattle Station, Ona

Line or group designation	Sh - Br. Cr.bred	3/4B 1/4S	3/4S 1/4B	P'bred Brah.	Angus	Brahman (David)	Brahman (Smoky)	Brahman (Emperor)	Cr.bred
Breed of sire	S'horn	Brahman	S'horn	Brahman	Angus	Brahman	Brahman	Brahman	Cr.bred ShxBr.
Breed of dam	Brahman	Cr.bred (Sh x Br)	Cr.bred (Sh x Br)	Brahman	Grade Brahman	Grade Cows*	Grade Cows*	Grade Cows*	Grade Brah.
No. cows bred (pasture)	18	18	3	8	21	60	45	34	32
No. cows calving	17	17	3	7	20	58	40	31	16
No. calves raised	17	16	3	7	20	56	39	31	16
Av. birth wt. (lbs.)	66	69	68	61	65	68	70	70	71
Av. birth date	2-26-51	3-18-51	3-15-51	12-18-50	3-16-51	3-28-51	3-4-51	3-16-51	3-5-51
Were calves creep fed?	Little	No	Little	Yes	No	No	No	No	No
Av. wt. six mon. (lbs.)	439	397	438	399	354	354	389	374	391
Av. weaning date	9-21-51	10-4-51	10-10-51	8-18-51	10-5-51	10-11-51	10-3-51	10-5-51	10-1-51
Av. weaning weight	488	431	477	501	385	375	432	402	446
Av. wean. type score **	9	10	12	10	10	9	9	9	10
Av. wean. cond. score **	10	10	11	10	10	8	9	9	11

* Mostly grade Brahman cows but few grade Devons, Shorthorns and Herefords.
** Medium = 6-8; Good = 9-11; Choice = 12-14.

GEORGIA STATION

Submitted by B. L. Southwell, Dec. 27, 1951

1. Project Title: The Improvement of Beef Cattle in Georgia Through the Use of Selection for Economic Factors Brought Out in the Process of Inbreeding, Crossbreeding, and Outbreeding.

2. Objectives:

   (a) Sire testing studies with Polled Hereford and Angus cattle.

   (b) The value of the Brahman breed in developing cattle that are better adapted to the climatic and feed conditions of the Coastal Plain area of the Southeast.

3. Accomplishments during the year:

   (a) No Polled Hereford or Angus cattle were acquired for the cooperative breeding project during the calendar year 1951. Some heifers were added to each group and one or two old cows were culled from each group. Most of the off-spring will be added to the herd to increase the size of the Polled Hereford herd. The Angus off-spring will be added only as replacements.

   Grade Hereford brood cows are being used in the crossbreeding studies. Most of these cows are $\frac{1}{2}$-Hereford x $\frac{1}{2}$-native but a few are high grade Hereford. The crossbred females will be retained for future breeding studies.

   No new equipment has been added during the year other than items needed for immediate use.

   (b) 1. Polled Hereford Sire Testing Studies: Two bulls were proved during the fall and winter 1950-51. All of the off-spring, both bulls and heifers, were placed in dry lot approximately two weeks after weaning and full-fed for 140 days. At the end of the feeding test each off-spring received a rating based on the following formula:

$$\text{Rating} = \text{Type Score} + \frac{\text{Av. Daily Gain}}{.05}$$

   Each sire received a rating equal to the average of all his off-spring. Polled Hereford sire No. 189 received a rating of 79.99 while sire No. 514 received a rating of 76.04. Type score in the above formula accounts for 45 percent of the rating while the rate of gain accounts for 55 percent. Neither sire groups included an outstanding bull calf, therefore, no prospective herd sires were selected from them.

Georgia Station (continued)

2. Angus: Only one Angus sire group was represented in the sire studies during 1950-51. This bull based on the performance of all sons and daughters received a rating of 75.54 which was not as good as either of the Hereford bulls. The Angus calves in general were better in type than the Polled Hereford but the rate of gain was less.

Both the Polled Hereford and Angus calves were full-fed Coastal Bermuda hay and were also full-fed a grain mixture composed of the following:

6 parts cracked shelled corn
1 part cottonseed meal (36% protein)

The calves were creep fed the same grain mixture during the suckling period.

3. Crossbreeding Studies: First-cross Brahman Versus First-cross Angus Calves. The first-cross Brahman and the first-cross Angus calves were out of comparable grade Hereford dams. They were creep fed the same grain mixture as were the Polled Hereford and Angus calves during the suckling period. The steer calves were slaughtered at weaning when they were approximately 220 days of age. Birth weights and slaughter data are attached. The heifer calves were retained. They have been placed in dry lot to be fed comparably to the 1951 Polled Hereford and Angus calves.

Thirteen, $\frac{1}{2}$-Brahman x $\frac{1}{2}$-Grade Hereford heifers were brought to the Tifton Station from Alapaha in the spring of 1951. These heifers had previously been bred to an Angus bull. They were handled comparably to the grade Hereford herds. The steer calves were slaughtered at weaning. Data concerning this group are attached.

4. Future Plans:

Sire testing studies with Polled Herefords will be continued. It is hoped to increase the purebred test herd to the extent that three to four bulls can be proved each year rather than the two. It is also hoped that this Station will be able to establish three or four inbred lines of Polled Herefords. The various lines will be obtained from already good performing Polled Hereford herds.

Because of the lack of facilities only a small herd of Angus (20 to 30 brood cows) will be maintained.

The grade Hereford cows have been re-bred to the Angus and the Brahman bull for the 1952 calf crop. The first-cross Brahman and the first-cross Angus from the 1950 calves were bred to a Polled Hereford bull in the spring of 1951 and will drop their first calves in early 1952. The breeding performance of these two crosses will be studied.

5. Publications:

Other than previous annual reports no publications have been made concerning the breeding work to date.

POSTWEANING PERFORMANCE OF 1950 CALVES FULL FED AFTER WEANING

Georgia Station
Coastal Plain Station, Tifton

Line or group designation	Sire Testing		Sire Testing	Cross-breeding	Cross-breeding
Location	Tifton, Ga.		Tifton, Ga.	Tifton, Ga.	Tifton, Ga.
Breeding of calves	Polled Here.		Angus	Brahman x Grade Here.	Angus x Grade Here.
	Sire No. 189	Sire No. 514			
Bulls					
No.	12	10	6		
Av. weaning wt.	511.9	463.3	542.3		
Av. 12 mo. wt.	849.0	759.6	850.5		
Length of feeding period	140 da.	140 da.	140 da.		
Av. daily gain on test	2.41	2.12	2.20		
Av. type score (12 mo.)*	79.50	75.51	81.57		
Heifers					
No.	9	7	6	6	6
Av. weaning wt.	526.1	426.4	456.8	476 6	419.1
Av. 12 mo. wt.	810.8	711.1	700.0	708.3	673.6
Length of feeding period	140 da.	140 da.	140 da.	140 da.	140 da.
Av. daily gain on test	2.05	2.03	1.73	1.65	1.82
Av. type score (12 mo.)	82.9	76.8	82.9		

* On the basis of 100 as an extreme top score.

PERFORMANCE OF COW HERDS. 1951 CALVES

Georgia Station
Coastal Plain Station, Tifton

Line or group designation Location	Sire testing Tifton, Ga	Sire testing Tifton, Ga.	Cross-breeding Tifton, Ga.	Cross-breeding Tifton, Ga.	Cross-breeding Tifton, Ga.
Breed of sire	P. Here.	Angus	Brahman	Angus	Angus
Breed of dam	P. Here.	Angus	Gr. Here.	Gr. Here.	½Br. ¼Here. ¼ Native
No. cows bred	47	19	18	18	13
No. cows calving	40	17	14	16	13
No. calves raised	39	17 (1 Angus calf died. 1 cow raised twins)	13	15	13
Av. birth wt. (lbs.)	75	61	70	66	51
Av. birth date	Feb. 26	Feb. 6	Feb. 21	Feb. 15	Feb. 17
Were calves creep fed?	Yes	Yes	Yes	Yes	Yes
Av. wt. at approx. 6 mo.	366	361	385	355	348
Weaning date	Sept.19	Sept. 19	Sept. 19	Sept.19	Sept.19
Av. weaning wt.	449	473	500	479	446
Av. weaning type score* (A.H. Form #522)	75	78			
Av. weaning cond. score	Good +	Good +			
Calves slaughtered at weaning:					
Sex			Steers	Steers	Steers
No.			6	6	8
Av. age			200 da.	215 da.	216 da.
Av. wt.			491	484	456
Av. slaughter grade			Choice -	Choice -	Choice -
Av. dressing percent			53.8	52.1	56.0
Av. carcass grade			Good +	Choice -	Choice

* On the basis of 100 as an extreme top score.

LOUISIANA STATION

Submitted by R. A. Damon, Jr., Jan. 1952

1. Project Title: The Improvement of Beef Cattle for the Southern Region Through Breeding Methods.

2. Objectives:

(a) To develop types of beef cattle best suited to conditions along the Gulf Coast.

(b) To compare various crossbred, purebred and high grade cattle under Gulf Coast conditions with respect to rate of growth on pasture, fattening ability, and meat quality of steers.

3. Accomplishments during the year:

(a) Data were collected on the crop of calves resulting from the allotment described in last year's report. The results are shown in the accompanying tables.

(b) Thirty-six steers from this project have been placed in dry lot for fattening. Slaughter data will be collected from these steers at the end of the feeding period.

4. Future Plans:

When this project was initiated, use was made of the animals which were available in the commercial beef cattle herd maintained by the University. Unfortunately, no records had been kept on the breeding of the herd, therefore making it necessary to guess at the breeding in these animals. This situation has been corrected by the disposal of the animals of uncertain breeding. The proceeds from the disposal of these animals will be used to purchase animals better suited to the program.

The experiment has been revised and projected over a nine year period. The first three-year phase will consist of a breed crossing program. Six herds of 32 cows each will be assembled and a bull of a different breed will be allotted to each of these herds. The bulls will be Hereford, Angus, Brahman, Brahman-Angus, Shorthorn, and Charbray. The 32 cows in each herd will be made up of 8 Hereford, 8 Angus, 8 Brahman, and 8 Brahman-Angus. These cow herds will be kept intact for the three years, and allotted to a bull of a different breed each year. The Brahman-Angus cattle will come from the line of cattle developed at Jeanerette over a twenty-year period and will be treated as a separate breed.

The second three-year phase will be a program of back-crossing. The crossbred females produced during the first three years will be allotted to breeding herds which will be arranged so that crossbred

females will be back-crossed to each of the parental breeds. In each herd, there will be 24 crossbred females in addition to 8 purebred females corresponding in breeding to the breed of the bull assigned, except in the cases of the Shorthorn and Charbray lot where females of this breeding are not available.

The third three-year phase will be a three breed cross program, making use of the crossbred females produced in the first three years. Again, purebred females will be included in the cow herds.

Females produced in this project will be raised to two years of age, with the normal records being kept. It is hoped that facilities will become available in order to test the dam performance of the back-cross and three-breed-cross females. Steers will be fed out in dry lot each year and slaughter data will be collected.

5. Publications:

There have been no publications based on this project.

PERFORMANCE OF COW HERDS. 1951 CALVES

Louisiana Station
Baton Rouge

Breed of sire Breed of dam	Afric-Angus Afric-Angus	Afric-Angus 1/4 Br. 3/4 Here.	Here. 1/4 Br. 3/4 Here.	Here. Here.	Here. Angus	Brah. 1/4 Br. 3/4 Here.	Brah. 1/2 Br. 1/2 Here.	Brah. 1/2 Br. 1/2 Angus	Brah. Brah.
No. cows calving	13	2	6	7	3	7	7	4	3
No. calves raised	13	2	6	7	3	6	7	4	2
Av. birth wt. (lbs.)	66	70	64	68	72	66	63	60	53
Av. birth date	2-16-51	4-29-51	3-29-51	3-16-51	3-4-51	3-2-51	3-15-51	2-17-51	3-5-51
Were calves creep fed?	No	No	No	No	No	No	No	No	No
Av. wt. 6 mo. (lbs.)	362	365	356	355	356	384	378	392	308
Weaning date	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51
Av. weaning wt.	440	368	416	438	443	468	458	475	390

PERFORMANCE OF COW HERDS. 1951 CALVES (cont'd)

Louisiana Station
Baton Rouge

Breed of sire Breed of dam	Charbray Hereford	Charbray Angus	Charbray 1/4 Br. 3/4 Here.	Charbray 1/2 Angus 1/2 Here.	Angus 1/4 Br. 3/4 Here.	Angus Hereford	Angus Angus	S'horn 1/4 Br. 3/4 Here.	S'horn Hereford
No. cows calving	6	5	5	2	4	2	3	6	5
No. calves raised	5	5	5	2	3	2	3	6	5
Av. birth wt. (lbs.)	89	76	81	72	56	51	51	62	68
Av. birth date	3-6-51	3-19-51	3-27-51	2-23-51	3-4-51	3-11-51	3-7-51	3-6-51	3-13-51
Were calves creep fed?	No	No	No	No	No	No	No	No	No
Av. wt. 6 mo. (lbs.)	378	380	381	374	359	328	306	376	366
Weaning date	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51	11-5-51
Av. weaning wt.	453	432	450	465	430	390	363	422	419

MARYLAND STATION

Submitted by J. E. Foster and W. W. Green, Dec. 18, 1951

1. Project Title: C-14 A Study of the Productiveness of Purebred Beef Cattle in Maryland.

2. Objectives:

(a) To study productiveness of existing or introduced stocks of beef cattle. Productive characteristics measured will include rate of gain, economy of gain, market type, carcass quality, fertility, longevity, adaptation to environmental conditions, and other factors affecting the utility value of beef cattle.

(b) To compare selective criteria (individual and pedigree) with actual performance of progeny.

(c) To evaluate breeding technics for small purebred herds under the varying conditions encountered in practice in purebred herds.

(d) To attempt to produce beef cattle with superior productive capacities by linebreeding and selection. (Using criteria of selection as developed in this project and by cooperating stations in this and other regions.)

3. Accomplishments during the year:

One herd of Aberdeen-Angus cattle is now in the project as the Hereford herd reported last year was dropped from the project primarily due to a shift in the owner's objective concerning the herd.

The remaining herd of Aberdeen-Angus seems to be serving a useful purpose in that the problems encountered appear to be similar to those in other herds and, therefore, more concentrated effort on one herd seems justified. Semi-annual weights of all members of the herd have been secured as well as birth weights on all calves. Estimated weights for 6, 12, 18 and 24 months have been calculated for each animal where possible. A number of females and males have been added to the herd, of the latter, some were selected primarily on a growth rate basis.

Records and record forms have been modified and it is felt that progress has been made in establishing practical records and record forms for purebred breeders. Sufficient data has not as yet been accumulated to justify full analysis of the records.

4. Future Plans:

Cooperation will be continued with this one herd on the present basis. Additional herds will not be added unless more clerical help is available to the project.

Maryland Station (continued)

5. Publications:

None.

6. Publications Planned:

None.

1. Sub-Project C-14-a: Effect of Early Weaning on the Duration of Maternal Influences in Beef Calves.

2. Objectives:

(a) To attempt to develop a new technic for an earlier evaluation of feed lot performance, progeny testing, and genetic evaluation of beef animals.

(b) To develop sound feeling and management practices for beef calves weaned at an early age.

(c) To evaluate the calves' genetic ability to thrive under new systems of care.

3. Accomplishments during the year:

The data from the first two year's work has been summarized and the results are essentially as follows: No statistically significant differences in weight were found between the calves weaned at 90 days and at 180 days of age or between breeds at birth, 180, or 370 days of age or for any 28-day period throughout the trial. Significant differences did occur between sexes (heifers and steers) in weight at each 28-day period from 202 to 370 days of age.

Statistically significant differences in gain did not occur between weaning age groups or breeds from birth- 180, 118 - 180, 180 - 370, or 202 - 370 days of age although the gains were significantly different between groups from 90 - 180 days of age and between sexes from 202 - 370 days. The only significant difference found in T.D.N. required per pound gain was between sexes from 202 - 370 days (analysis of variance). Apparently this new method of management is unharmful to the calves from a growth standpoint. No unusual health problems were encountered.

Eight Aberdeen-Angus and three Hereford calves of the 1951 crop were weaned at 90 days and nine Aberdeen-Angus and three Hereford calves were weaned at 180 days of age as a continuation of the first two years' work. Up to date, the 1951 calves seem to be doing just about the same as in previous years although all of the data has not been analyzed as yet. The grain-hay ratio has been kept narrower during 1951 and is on a more practical basis.

Due to unforeseen circumstances, it was impossible to wean any of the 1951 calves at an age of 7 - 10 days as mentioned in the previous progress report.

4. Future Plans:

It seems probable that the next phase of this project can be initiated in the spring of 1952. Two sets of sire progenies will most likely to secured such that eight calves of each of two sires will be weaned at 90 and 180 days of age. Heritability studies will be attempted for both weaning age groups. If the above cannot be done calves will be weaned at 60 rather than 90 days or the project will be held open for a year.

Data for 1949, 1950, and 1951 will be analyzed.

5. Publications:

None.

6. Publications Planned:

A Master's thesis is about complete on the first two years' work.

1. Sub-Project C-14-b: Type Classification as an Aid in Selection of Beef Breeding Cattle.

2. Objectives:

To determine the value of type classification in beef cattle, i.e., heritability of beef type and production.

3. Accomplishments during the year:

Two herds have been classified twice during the year. Four herds were classified once. A total of 728 cattle were studied. No new analysis of the data was undertaken.

4. Future Plans:

Classification will be continued on a semi-annual basis on as many herds as possible. Additional analysis of the data will be done providing assistance is forthcoming.

5. Publications:

None.

6. Publications Planned:

One publication is contemplated providing some assistance is secured on the project.

Maryland Station (continued)

1. Sub-Project C-14-c: Studies on Bodily Conformation and the Correlations between Live Animal Measurements and the Weight and Other Characteristics of Carcasses and Wholesale Cuts in Beef Animals.

2. Objectives:

To study the correlations between linear measurements taken on the live animals and the weight of various wholesale cuts in order to explore the possibility of developing a technic for estimating probable carcass yield from linear measurements.

3. Accomplishments during the year:

Analysis of the predictability of the weights of the major wholesale cuts of beef by use of measurements taken on the live animal have been completed. Multiple correlation values between the weights of the cuts and the measurements are as follows: Cross-cut, 0.993; rib, 0.968; trimmed loin, 0.973; short loin, 0.933; rough loin, 0.975; sirloin butt, 0.962; and round, 0.933. These correlations include live weight as one measure. The zero order correlations of live weight and the weights of most of the cuts were in the neighborhood of 0.9. Combinations of various measurements for each cut were studied in order to find the most practical combinations for predictive purposes.

A study has been initiated on the predictability of (a) the combination of the round, loin, and rib and (b) the round, loin, rib and cross cut by use of live animal measurements for the estimation of the cut-out value of the animal. Most of the correlations have been completed on a study of the association of all wholesale cuts, one with another. A third study has been initiated to ascertain, if possible, the basic dimensions of beef cattle as far as describing type is concerned.

4. Future Plans:

The completion of the above mentioned initiated studies is contemplated. If facilities and funds are available, additional data on bodily dimensions will be secured and analyzed.

5. Publications:

A Master's thesis, "S Study of Relationships between Linear Measurements and Carcass Cuts of Beef Steers" by F. E. White has been completed.

A paper was presented at the 1951 meeting of the American Society of Animal Production and a manuscript has been prepared for publication on the topic "Relationships of Measurements of Live Animals to Weights of Wholesale Cuts of Beef" by F. E. White and W. W. Green.

6. Publications Planned:

As soon as the above mentioned new studies are complete they will be prepared in manuscript form.

PERFORMANCE OF COW HERDS. 1951 CALVES

	Maryland Station	
Line or group designation	Univ. of Md.	Univ. of Md.
Location	Univ. of Md.	Univ. of Md.
Breed of sire	Aberdeen-Ang	Hereford
Breed of dam	Aberdeen-Ang	Hereford
No. cows bred	23	13
No. cows calving	23	13
No. calves raised	23	12
Av. inbr. of dams (%)	Outbred herd	Outbred herd
Av. Inbr. of calves (%)	" "	" "
Av. birth wt. (lbs.)	61	65
Av. birth date	2-27-51	3-7-51
Were calves creep fed?	No	No
Av. wt. 6 mo. (lbs.)	342	348
Av. weaning date*	8-28-51	9-5-51
Av. weaning weight	342	348
Av. weaning type score**	13	13
Av. wean. cond. score**	12	12

* For calves weaned at 6 mo.; half were weaned at 90 days.

** Med. = 6-8; Good = 9-11; Choice = 12-14.

POSTWEANING PERFORMANCE OF 1950 CALVES FULL FED AFTER WEANING

	Maryland Station	
Line or group designation	Univ. of Md.	Univ. of Md.
Location	Univ. of Md.	Univ. of Md.
Breeding of calves	Aberdeen-Ang	Hereford
Av. inbreeding (%)	Outbred herd	Outbred herd
Steers, no. animals	8	4
Av. weaning wt.	360	332
Av. 12 mo. wt.	678	679
Length of feeding period	190 days	190 days
Feed per cwt. gain (lbs)	716	661
Concentrates	658	596
Roughage	58	66
Av. daily gain on test	1.68	1.83
Av. type score (12 mo.)	11	12
Heifers, no. animals	8	3
Av. weaning wt.	308	378
Av. 12 mo. wt.	603	712
Length of feeding period	190 days	190 days
Feed per cwt. gain (lbs)	728	694
Concentrates	669	630
Roughage	59	64
Av. daily gain on test	1.55	1.75
Av. type score (12 mo.)	12	12

NORTH CAROLINA STATION

Submitted by H. A. Stewart, Dec. 31, 1951

1. Project Title: State 74-ai28 The Improvement of Beef Cattle Through Breeding Methods.

   State 46-ai17 The Development of Beef Cattle Especially Adapted to the Coastal Plains Region of North Carolina and Similar Areas.

2. Objectives:

   (a) To compare groups of cattle from different topcrosses on grade Hereford cows for their adaptability under Coastal Plains forest conditions.

   (b) To establish breeding groups of cattle.

   (c) To obtain information on the feedlot performance of the purebred Hereford, the Brahman-Hereford F_1, and the Africander-Angus bulls to be used as sires next year.

   (d) To introduce new genetic material.

   (e) To study the total performance of progeny of bulls in the same herd.

3. Progress Made:

Brahman-Hereford crossbred calves were produced in 1950 and 1951 on Coastal Plain Forest ranges. The same matings are being continued for the 1952 calf crop. Seven Brahman-Hereford F_2 calves were dropped during 1951, and 21 F_2 cows of this breeding are now in this breeding group, One polled F_1 bull was used to sire the 1951 calf crop and another was used this year. A few polled F_2 calves have been dropped. An attempt is being made to fix this trait in the breeding group. Selections are being made to eliminate animals difficult to handle under our system of management.

A red Africander-Angus bull calf was purchased from the Jeanerette station in the fall of 1950. He was fed with the other bulls on the rate of gain trial during the past winter at Raleigh. During the breeding season he was moved to the forest where he was used with a group of 13 Africander-Hereford F_1 and F_2 females. This bull made an average daily gain of 2.03 pounds for a feeding period of 160 days on pasture with limited grain.

The grade Hereford group is being maintained at the Forest as a check on the performance of the other breeding groups. Cows from this group are being mated to produce both grade Hereford and Brahman-Hereford calves. As the other breeding groups become established the practice of producing crossbred calves will be discontinued.

North Carolina Station (continued)

Six Romo Sinuano-Hereford F_1 heifers are now at Raleigh. Three of these have been bred to F_1 bulls of the same breeding. The 10 Romo Sinuano-Hereford bulls on the bull feeding trial averaged 1.80 pounds per day while the 8 purebred Hereford bulls with them averaged 1.76 pounds. One of the crossbred bulls of this group made 2.5 pounds per day for a period of 196 days.

Body temperature, pulse rate and respiration comparisons were made between Romo Sinuano-Hereford crossbred bulls and purebred Hereford bulls of the same age and environmental treatment under conditions of controlled temperature and humidity. Under periods of temperature stress the external signs of stress indicate that the crossbred animals adjust more rapidly to increased temperatures than the purebred Herefords. The respiration rate of the Herefords appears to be higher than that of the crossbreds. Skin temperature of the crossbreds appears to be higher than that of the Herefords.

Eight purebred Hereford bull calves were fed for 168 days. Four of these were later used on grade cows, 2 at each of 2 outlying stations. The young bulls used for the 1951 calf crop at the Mountain station failed to breed early in the season so an older bull was used that sired the greater portion of the calf crop. Breeding performance of young bulls at the Tidewater Station was satisfactory. There is no difference between sire progenies in weaning weights at either station. All young bulls used in 1951 performed in a satisfactory manner.

4. Future Plans:

Feed lot testing is being continued on all bull calves at Raleigh, including prospective herd sires from the various crossbred groups.

Sample steer progenies from the tested bulls used on grade herds will continue to be fed for slaughter grade and carcass evaluation. Heifer gains on pastures will be compared to the feed lot gains of their steer mates.

Inter se matings will be continued within each of the three groups: Brahman-Hereford, Africander-Hereford-Angus; and, Romo Sinuano-Hereford. Selections within these groups will be based on reproductive performance,rate of gain and carcass quality.

5. Publications:

Godley, W. C. and H. A. Stewart. The Suckling Performance and Post-weaning Gains of the Progeny of Two Beef Bulls. Jour. An. Sci. 10:1025, 1951 (abstract)

6. Publications Planned:

Station circular on procedures in evaluation of animals.

Differences in response to temperature stress by cattle of divergent origin.

POSTWEANING PERFORMANCE OF 1950 CALVES FULL FED AFTER WEANING*
(or pastured for high gains)

North Carolina Station

Line or group designation	Hereford	Angus	Romo Sinuano	Africander-Angus
Location	Raleigh			
Breeding of calves	P'bred Hereford	P'bred Angus	R S x Here.	Afr. x Angus
Av. inbreeding (%)	0	0	0	
Bulls				
No.	8	1	10	1
Av. weaning wt.	497	405	338	465
Av. 12 months wt.	806	640	652	790
Length of feeding period	196	168	196	160
Av. daily gain on test	1.76	1.46	1.80	2.03
Heifers				
No.	2	2	5	
Av. weaning wt.	435	412.5	339	
Av. 12 month wt.	635	577.5	552	
Length of feeding period	1 yr.	1 yr.	1 yr.	
Av. daily gain on test	.86	1.03	1.24	
Av. type score (12 mo.)**	13	13	16	

* Fed on winter pasture with limited grain.

** Scoring system in North Carolina report: Medium = 6-8; Good = 9-11; Choice = 12-14; Fancy = 15-17.

PRODUCTION AND SLAUGHTER DATA ON YEARLING AND OLDER CATTLE
NOT INCLUDED IN BREEDING HERDS IN 1951

North Carolina Station

Line or group designation	Grade Hereford		
Breeding:	Steers	Grass silage Heifers	Grass hay Heifers
Sex:			
No.	12	10	10
Av. age (fall 1950)	10 mo.	10 mo.	10 mo.
Av. wt. (fall 1950)	431.7	386.5	387
Av. winter gain	36.2 (on pasture)	212.0	100
Days on pasture	213	144	144
Gain on summer pasture	358	147	211
Animals slaughtered:			
Av. age at slaughter	20 mo.	19 mo.	19 mo.
Av. slaughter wt.	826	746	697.5
Av. slaughter grade	8.33	9.1	7.6
Av. dressing per cent			
Av. carcass grade	9.25		

PERFORMANCE OF COW HERDS, 1951 CALVES

North Carolina Station

Line or group	Gr.Here.	Gr.Here.	P.B.Here.	Angus	S'horn	Gr.Here.	Gr.Here.	Brah. x Here.F_1	Brah. x Here.F_2	Africander x Here.F_2
Location	Tide-Water	Laurel Springs	Raleigh	Raleigh	Raleigh	Raleigh	Frying Pan	Frying Pan	Frying Pan	Frying Pan
Breed of sire	PB Here.	PB Here.	Here.	Angus	S'horn	PB Here.	PB. Here.	Brah.	Br x H F_1	Af x H F_2
Breed of dam	Gr. Here.	Gr.Here.	Here.	Angus	S'horn	Gr.Here.	PB Here.	Gr. Here.	Br x H F_1	Af x H F_1
No. cows bred	40	41	23	8		28	20	21	14	11
No. cows calving	39	36	18	7	5	28	12	13	11	10
No. calves raised	39	35	16	6	5	28	10	13	7	9
Av. inbr., dams (%)	0	0	0	0	0	0	0	0	0	0
Av. inbr.,calves (%)	0	0	0	0	0	0	0	0	12.5	9
Av. birth wt. (lbs)	Not taken	66.5	56.5	56 3	67.3	65	Not tkn.	Not tkn.	Not tkn.	Not tkn.
Av. birth date	3-27-51	2-24-51	1-11-51	1-3-51	2-27-51	2-1-51	3-23-51	3-26-51	3-22-51	3-18-51
Were calves creep fed?	No	No	Yes	Yes	Yes	Yes	About half of each group			
Av. wt. at 6 mo.(lbs)	285	378	382	378	416	415	222	286	323	300
Av. weaning date	10-26-51	9-28-51	10-11-51	10-5-51	10-5-51	9-25-51	11-15-51	11-15-51	11-15-51	11-15-51
Av. weaning weight	302	414	545	563	521	498	264	334	392	369
Av. wean. type score	9	12.1	12.5	11.3	11.0	11.0	6.7	7.8	9.0	8.3
Av. wean. cond.score	9	12.1	12.5	11.3	11.0	11.0	6.7	7.8	9.0	8.3

SOUTH CAROLINA STATION

Submitted by E. G. Godbey, Dec. 21, 1951

1. Project Title: The Use of Brahman and Certain British Breeds of Beef Cattle in the Production of Fat Calves.

2. Objectives:

The objectives of this test were to determine the birth and weaning weights, market grades, carcass grades and dressing percentages of fat calves sired by Brahman, Hereford and Angus bulls. The calves at the coast station were out of purebred Angus cows and those at the college were out of purebred Hereford cows.

3. Accomplishments during the year:

(a) Facilities and cattle acquired: One Brahman bull was replaced at the coast station. One Hereford bull was replaced at the college.

(b) Research results: Research results at each station are shown in the accompanying tables. At both stations the crossbred calves were heavier than the purebreds at birth and at weaning.

The Angus-Hereford calves were about 15 pounds heavier than the Brahman-Hereford calves at weaning.

All the Angus calves from Angus cows have not been weaned. Calves sired by the Hereford and Brahman bulls had about the same weaning weight.

4. Future Plans:

It is planned to secure data on one more crop of calves at the coast station and two more calf crops at the college.

5. Publications:

Results have been published in the South Carolina Experiment Station Report.

PERFORMANCE OF COW HERDS. 1951 CALVES

South Carolina Station

Line or group designation	Hereford	Brah. x Here.	Ang. x Here.	Angus	Brah. x Ang.	Here. x Ang.
Location	Clemson Col.	Clemson Col.	Clemson Col.	Coast Sta.	Coast Sta.	Coast Sta.
Breed of sire	Hereford	Brahman	Angus	Angus	Brahman	Hereford
Breed of dam	Hereford	Hereford	Hereford	Angus	Angus	Angus
No. cows bred	17	12	15	17	14	20
No. cows calving	16*	10	14	17	14	20
No. calves raised	14**	10	14	16	14	20
Av. birth wt. (lbs.)	66	72	73	66	86	74
Av. birth date	Feb. 28	Mar. 22	Mar. 3	Feb. 21	Apr. 2	May 9
Were calves creep fed?	Yes	Yes	Yes	Yes	Yes	Yes
Av. weaning date	Sept. 26	Oct. 18	Sept. 29	Sept. 19	Oct. 29	Oct. 5
Av. wt 7 mo. (lbs)****	450	481	497	476 (14)	551 (9)	548 (9)
Calves slaughtered at wean.:						
Steers, no. animals	4	5	7	5	5	8
Av. age	215 da.	212 da.	216 da.	216 da.	215 da.	217 da.
Av. wt.	495	490	527	506	571	562
Av. slaughter grade***	14.4	20	16.6	12.2	15.8	12.2
Av. dressing percent	57.12	56.41	55.55	58	59.8	58.9
Av. carcass grade***	18.3	18.4	16.8	13.7	13.8	13.1

* 2 cows had late calves and were not used. 1 cow did not breed and was sold.

** 14 calves were used on test.

*** Med. = 20-34; Good = 14-18; Choice = 8-12.

**** Numbers in parenthesis are number of calves weighed at last report.

TENNESSEE STATION

Submitted by C. S. Hobbs and H. J. Smith, Jan. 4, 1952

1. Project Title: The Improvement of the Producing Ability of Beef Cattle.

2. Objectives:

   (a) To develop lines or line crosses, or combinations of lines and crosses of beef cattle that will make the most efficient use of Tennessee pastures and forages and that will result in an improvement of such characters as rate of gain, economy of gain, carcass quality, fertility and longevity.

   (b) To investigate the productiveness of existing lines of beef cattle.

   (c) To develop effective breeding techniques for improving the productiveness of existing lines of beef cattle.

   (d) To study the effect of different levels of nutrition on the development of type, conformation, economy of gain, fertility, and longevity.

3. Accomplishments during the year:

   (a) Facilities and cattle acquired: Beef cattle breeding research under S-10 at the Tennessee Station includes herds at Knoxville, Greenville, Crossville, Columbia, Springfield, and Oak Ridge. The main effort up to the present time has been expended in an expansion of all herds and building up of facilities in order to carry out adequately the objectives of the project. Grade cow herds now carried at some stations are being replaced with purebred herds as rapidly as time and funds permit. Most of the increase in cattle numbers during 1951, exclusive of replacements raised in and added to respective herds, has been cattle added to the breeding program at the main station at Knoxville.

   Knoxville: One hundred seventy-one purebred Herefords were added during 1951 to the Tennessee beef cattle breeding project through a cooperative program involving the University of Tennessee and the Aluminin Company of America. These purebred Herefords which included 88 cows and 83 heifer and bull calves were purchased by Alcoa to utilize improved pastures being developed on land owned by this company and surrounding the Alcoa plants located at Alcoa, Tennessee, 12 miles from Knoxville. The University of Tennessee will have full control of the breeding program undertaken with this herd. This herd will be expanded as rapidly as possible to about 200 cows. Primary emphasis for improvement will be placed on mass selection and the use of performance and progeny tested bulls. It will be used primarily

for the progeny testing of desirable type bulls which have been performance tested in the feedlot. About 10% of the bull calves from the herd will be performance tested each year. Only heifer calves from performance and/or progeny tested bulls will be saved for replacements.

In addition to the above named, the following cattle have also been acquired at Knoxville:

(1) Twelve Hereford heifer calves (4 trios) for the level of feeding study.
(2) One proven Angus herd sire for the herd at Knoxville.
(3) Two Angus bulls for use in the breeding program.
(4) Four Angus heifers for the herd at Knoxville.

(b) Research results:

(1) Performance of the cow herds at the main and branch stations for 1951 are shown in the accompanying tables. Type and condition scores are reported as recommended by the Committee on Methods of Measurement. The numerical scores for type and condition range from 0 to 17 as suggested by the committee.

(2) Growth data and weaning weights of calves at the Greenville and Crossville stations have been analyzed in a study of the factors affecting weaning weights of beef calves and the development of correction factors for use in adjusting weaning weights to a standard age. A paper was presented on this work at the February, 1951, meeting of the Association of Southern Agricultural Workers at Memphis, Tennessee. The results from the data analyzed do not support the idea that a single correction factor can be used which will apply to calves raised in different environments. The most satisfactory method found for adjusting individual calf weights to a standard age was that of prorating gain between 28 day weights bracketing the standard age. This method takes into account the shape of the individual calf's growth curve about the standard age. To utilize this method most effectively, it will be necessary to weigh all calves at periodic intervals (28 days for Tennessee) beginning when the first calf reaches 6 months of age (standard age for S-10) and ending when all calves are weaned. If single weaning weights only are available, a satisfactory adjustment for an average can be made by using regression techniques. These methods do not, however, adjust individual calf weights within groups very accurately, particularly when the standard age is very far removed from the weaning age. All methods, in general, gave good results when adjustment was made from a weigh day close to the standard age. Average daily gain from birth to weaning proved to be less satisfactory than other methods. This method slightly underestimated the average of the actual weights as represented by comparison with the standard method. This is due to a tendency for the growth curve to level off slightly during the later part of the growth period preceeding weaning.

(3) The photographic chute was used routinely to obtain permanent photographic records and measurement data on all animals in the breeding program at all stations. Future plans include an effort to work out methods of obtaining photographic records of width and thickness.

(4) A study of the effect of level of nutrition on the development of type, conformation, economy of gain, fertility and longevity was initiated during 1950. Five trios of calves were fed at three different levels of nutrition within trios during 1950-51. The three nutritional regimes studied were:

(a) Nurse cow plus a full feed of concentrates and hay: This calf was allowed all of the milk it would take from a nurse cow before and after weaning. The milk from the nurse cow was continued from weaning to the time the calf was removed from the test and placed with the breeding herd or slaughtered. In addition to milk, this calf was fed all of the concentrates and hay it would consume throughout the entire test. Heifer and bull calves were removed from their respective regimes at 18 months of age and steers at 900 pounds of weight.

(b) Full feed of concentrates and hay: This calf was fed a full feed of concentrates and hay during the entire experiment with milk from the calf's own dam up to weaning time only.

(c) Customary practices for good commercial production: This calf was carried primarily on grass and roughages with milk from the calf's own dam up to weaning only. During the wintering phase 4 pounds of concentrates, 8 pounds of silage and a full feed of hay was fed daily.

The three calves of a trio were selected to be as nearly identical in type and breeding as possible so that expressed differences in growth and development would be due largely to methods of management. Individual trios were of the same breed, sex, age (not more than 4-8 weeks difference), as close as possible to weight, and by the same sire. They were selected from cows of similar type, age, breeding and performance. Calves within trios were randomly allotted to the different management regimes.

The calves were placed on test while still on their dams at an initial weight of approximately 300 pounds and $4\frac{1}{2}$ months of age. All calves were weaned at about 7 months of age and continued on their respective treatments to 18 months of age for bull and heifer calves and 900 pounds of weight for steers. All heifers at about 18 months of age are being put into the herd where detailed information on breeding, calving, body weight and size will be obtained for two or more years on each trio.

The calves on regimes A and B were individually fed all of the concentrates and hay they would consume. Concentrates and hay were fed separately with daily weighbacks. The concentrate mixture consisted of corn, oats, wheat bran, and cottonseed meal. The hay was high-quality alfalfa hay.

Three Angus and two Hereford trios were carried through growth and development phases during 1950-51. The results are given in Tables 1 and 2.

4. Future Plans:

(a) Continue the progeny testing of sires to be used in the breeding program.

(1) Two Herefords at Columbia.
(2) Two Herefords at Greenville.
(3) One Hereford, two Angus, and one Shorthorn at Crossville.
(4) Four Herefords at Alcoa.

(b) Continue the program of changing from grades to purebreds at Greenville, Springfield, Crossville, and Columbia.

(c) Continue the program of performance testing young bulls. 12 Hereford bulls and 1 Angus bull will be tested during 1951-52 at the Knoxville Station.

(d) Continue the expansion of herds and the development of lines at Greenville, Crossville, Springfield and Knoxville.

(e) Continue the level of feeding study. Plans are to carry four Hereford and two Angus heifer trios through growth and development phases during 1952. First year reproductive performance of heifer trios fed during 1951 will be studied.

(f) Analyze and study cow performance records at all of the stations where such records have accumulated over a period of years.

(g) Continue the study on objective methods of obtaining linear measurements of beef cattle. The photographic chute will be used to obtain measurement data on all animals in the breeding program at all stations. An effort will be made to work out methods of obtaining photographic records of width and thickness.

5. Publications: Butts, Will T., H. J. Smith, E. J. Warwick and C. S. Hobbs. Correction Factors for Adjusting Weaning Weights of Beef Calves. Proc. Assn. South. Agr. Workers. p. 76, 1951 (abstract)

Butts, Will T. Correction Factors for Adjusting Weaning Weights of Beef Calves to a Standard Age. Thesis for M.S. degree, University of Tennessee, 1951.

6. Publications Planned:

Results from an analysis of cow performance records.

Table 1. Body Measurements (18 months) 1/

Nutritional regime	Circ. of heart girth Cm	Patella to patella Cm	Height at withers Cm	Depth at chest Cm	Length of body Cm	Width of cannon bone Cm
A. Nurse cow plus a full feed of concentrates and hay	194	103	110	64	132	6.9
B. Full feed of concentrates and hay	177	98	109	60	125	6.7
C. Customary practices for good commercial production	166	95	109	57	122	6.6

1/ These averages include four trios only. One steer trio is not included.

Table 2. Growth Data of Calves on Different Nutritional Regimes Within Trios

Nutritional Regime	Av. init. age days	Av. init. type grade*	Av. init. wt. lbs.	Final wt. lbs.	Av. daily gain on test lbs.	Av. final cond. grade* 18 mos.	Av. final type grade* 18 mos.
A. Nurse cow + full feed concentrates and hay	141.2	12	321.6	1012.2	1.80	15.4	13.0
B. Full feed of concentrates and hay	145.2	12	301.8	904.6	1.60	13.6	12.3
C. Customary practices for good commercial production	135.8	12	319.8	802.4	1.17	10.4	11.1

* Med. = 6-8; Good = 9-11; Choice = 12-14; and Fancy = 15-17.

PERFORMANCE OF COW HERDS. 1951 CALVES

Tennessee Station

Line or group designation Location Breed of sire Breed of dam No. cows bred	Grade Angus Cross-ville Angus (UT Eppy) Grade Angus 7*	Grade Angus Cross-ville Angus (UT Black) Grade Angus 10	Angus Cross-ville Angus Oak 2) Angus 9	Grade Herd Cross-ville Here. Grade 21	Grade Herd Cross-ville S'horn Grade 20	McCrosky Angus Knox-ville Angus Angus 9	Angus Knox-ville Angus Angus 20**	Early Calving Green-ville Angus Grade Here. 9	Early Calving Green-ville Here. Grade Here. 10	Late Calving Green-ville Angus Grade Here. 9	Late Calving Green-ville Here. Grade Here. 10
No. cows calving	7	10	9	20	17	9	20	9	10	9	10
No. calves raised	7	10	9	20	17	9	19	9	9	9	10
Av. birth wt. (lbs.)	63	68	65	69	73	63	61	63	77	71	69
Av. birth date	Apr. 7	Apr. 12	Mar. 26	Apr. 27	Apr.21	May 31	Feb. 13	Jan. 13	Jan.17	Mar.15	Mar.15
Were calves creep fed?	No	No	No	No	No	No	No	No	No	No	No
Av. wt. 6 mo. (lbs.)	388	404	385	375	405	376	350	400	378	418	385
Av. weaning date	Oct.31	Oct.31	Oct.31	Oct.31	Oct.31	Nov.12	Oct.20	Oct.30	Oct.30	Oct.30	Oct.30
Av. weaning weight	433	444	454	385	418	403	476	-	-	-	-
Av. weaning type score***	12.0	12.8	13.5	11.0	11.0	12.6	12.1	11.9	10.8	11.4	11.1
Av. wean. cond. score***	11.0	11.6	11.6	11.0	11.0	11.4	11.3	11.6	11.0	11.3	11.1

* Two out of season calves not included.
** Cows calving in spring only.
*** Med. = 6-8; Good = 9-11; Choice = 12-14.

TEXAS STATION

Submitted by Bruce L. Warwick, M. W. Hazen and Carl M. Lyman, Jan. 1952

1. Project Title: This work is supported by three Texas State Projects. The first of these, R-M 607 "Improvement of Beef Cattle Through Selection of Performance-Tested and Progeny-Tested Sires" is in progress at Balmorhea, McGregor, and Panhandle, Texas.

2. Objectives: Project R-M 607

(a) To determine the heritability of gain and other economic characteristics as beef conformation, quality of fleshing, earliness of maturity and size of animal.

(b) To study the effects of the application of such information on the improvement of breeding herds.

(c) To determine the mode of inheritance of the pigmentation of the eyelids and to determine the relationship of eyelid pigmentation to "cancer eye".

(d) To make a more detailed analysis of the existing data resulting from previous work that has been carried out under Texas Experiment Station Project 550.

(e) To determine suitable and economical rations of locally grown feeds and supplements for proper development of young breeding stock in conjunction with Texas Station Project 550.

3. Accomplishments during the year:

Evaluation of calves for gaining ability on growing rations in the feed lot was conducted at Balmorhea, Panhandle and Bluebonnet Farm, McGregor, Texas. Of the 443 head tested at these three points, 289 were raised and owned by cooperators. The other 154 were raised by the Texas Station on experiment R-M 650 listed below, and the results were used directly for selection of individuals and of sires. There was great variability between sire groups and between individuals. Two sires represented by progeny at McGregor were the highest gaining bulls in the 1948-49 test at Balmorhea. Of the 5 bull calves sired by these, three were in the top 25 per cent and 4 of the 5 were above average even though one of the progeny was among the lowest gaining Hereford bulls on test. The heifer and steer progenies of these sires were above the respective averages. Additional high gaining sires have been secured on loan by the Station and their progenies will be tested in the future. The results of the tests are being used for selection purposes by private breeders as well as in the Station herds. Attached are "Post Weaning Performance of 1950 calves, full fed after weaning" for the tests at McGregor, Panhandle, and Balmorhea.

Texas Station (continued)

1. Project Title: R-M 650 Improvement of Beef Cattle Within Purebreds and Certain of Their Crosses Through Breeding Methods Based on Evaluation Tests for Efficiency and Rate of Gain, Heat Tolerance and Carcass Value.

2. Objectives: Project R-M 650

(a) The improvement of beef cattle by selection based on rate and economy of gain, breeding efficiency and carcass value.

(b) To evaluate cattle with regard to environment, especially heat tolerance.

(c) To develop strains of beef cattle especially adapted to southern climatic conditions by a breeding program using Brahman Cattle and one of the European breeds.

(d) To improve the carcass value of cattle of predominantly Brahman breeding by introducing characteristics from one of the European breeds.

3. Accomplishments and Future Plans:

This project at Bluebonnet Farm near McGregor, Texas presently includes approximately 300 unregistered and crossbred females and 57 purebreds, besides 238 calves and 15 breeding bulls. Comparisons are being made between purebred Brahmans, purebred and unregistered Herefords, and crosses between the Brahman and Hereford breeds. Crossbred heifers produced are being back-crossed to both parental breeds and selection is being made for the characteristics leading to high performance. Attached are "Performance of Cow Herds, 1951 Calves", and "Post Weaning Performance of 1950 Calves, Full Fed After Weaning".

1. Project Title: R-M 714 Methods of Measuring Potential Efficiency of Feed Utilization in Immature Animals.

2. Objectives: R-M 714

The development of tests that will measure the potential rate of gain and feed efficiency of calves at an immature stage.

3. Accomplishments during the year:

Investigations were carried on during the year on blood levels of thyroxine and 17-keto steroids obtained on small numbers of animals which suggest some relationships. The work is being continued.

POSTWEANING PERFORMANCE OF 1950 CALVES FULL FED AFTER WEANING, 1950-51 TEST

Calves owned by cooperators	Texas Station				
Line or group designation					
Location	Pan Tech Farms (all bulls)			Balmorhea	
Breeding of calves	Here. and Angus	Here.	Angus	3/ Bulls	Here. Heifers
No. animals	70	62	8	111	54
Av. initial wt. (lbs.)	567	569	547	540	498
Av. final weight	902	905	885	865	750
Days on feed	140	140	140	139	139
Feed per cwt.gain (lbs) 2/	759	760	752	841	1041
Concentrates	179	179	177		
Roughage	508	581	575		
Av. daily gain on test	2.4	2.4	2.41	2.34	1.81
Initial grade 1/	13.2	13.2	12.8		
Final grade 1/	14.1	14.2	13.2		
Highest daily gain	2.91	2.91	2.63	3.23	2.28
Lowest daily gain	1.32	1.32	1.97	1.83	1.38

1/ Grades of 8-12 = choice; 14-18 = good; 20 and over = medium.

2/ The Pan Tech ration was brought up to the following by December 18 and fed to end of test, April 15, 1951. Ration ground, mixed, and self-fed.

Hegari fodder	55	(est. grain content 18%)
Alfalfa hay	20	
Cottonseed meal	15	
Hegari grain	10	

Balmorhea ration: After starting at lower levels, cottonseed meal was fed at rate of three lbs. per day and cottonseed hulls at rate of two lbs. per day. Remainder of ration hegari fodder with an estimated grain content of 25%. Ration ground, mixed, and self-fed.

3/ 102 Herefords, 9 Santa Gertrudis.

POSTWEANING PERFORMANCE OF 1950 CALVES FULL FED AFTER WEANING

Texas Station

All calves on test at Bluebonnet. 1950-51 Test.

Line or group designation Location Breeding of calves Av. inbreeding (%)	Registered Herefords Bluebonnet Hereford	Registered Brahman Bluebonnet Brahman	F_1 Brahman x Hereford Bluebonnet F_1	Unregistered Herefords Bluebonnet Hereford
Bulls, no. animals	31*	20*	None	None
Av. wt. 11-20-50	603	472		
Av. wt. 4-23-51	956	734		
Length of feeding period	154	154		
(2) Feed per cwt. gain (lbs)	895	880		
Concentrates	374	368		
Roughage	521	512		
Av. daily gain on test	2.3	1.7		
(1) Av. type score, 4-23-51	16	16		
Highest daily gain	3.0	2.1		
Lowest daily gain	1.2	1.1		
Steers, no. animals			54	19
Av. wt. 11-20-50			486	489
Av. wt. 4-23-51			838	832
Length of feeding period			154	154
(3) Feed per cwt. gain (lbs)			Fed in mixed pen	
Av. daily gain on test			2.3	2.2
(1) Av. type score, 4-23-51			16	16
Highest daily gain			2.3	2.3
Lowest daily gain			1.5	1.8
Heifers, no. animals	17*	5*	34	16
Av. wt. 11-20-50	518	437	449	460
Av. wt. 4-23-51	760	639	720	724
Length of feeding period	154	154	154	154
(2) Feed per cwt. gain (lbs)	Fed in mixed pens			
Av. daily gain on test	1.6	1.3	1.8	1.7
(1) Av. type score, 4-23-51	13	13	16	14
Highest daily gain	1.9	1.6	2.2	1.9
Lowest daily gain	1.1	.9	1.3	1.4

* 26 Hereford bulls, 18 Brahman bulls, 11 Hereford heifers, and 4 Brahman heifers owned by cooperators. Other animals raised at Bluebonnet and owned by Texas Station.

(See next page for other footnotes regarding this table.)

Texas Station

Footnotes for previous table:

(1) Grades: 2-6 = Fancy; 8-12 = Choice; 14-18 = Good; 20-24 = Medium; 26-30 = Common.

(2) Ration for Bulls and Heifers:

Milo grain	25
Cottonseed meal	15
Hegari fodder (10% grain)	25
Alfalfa hay	15
Johnson grass hay	20

The last three weeks the Johnson grass hay was replaced by Alfalfa hay.

(3) The ration for the steers was brought up to 66-68 per cent concentrates, the availability of different feeds leading to some variation. Barley and sesame seed were included until our supply was exhausted. The ration at the last of the test was:

Milo grain	28
Snapped corn	15
Ground shelled corn	15
Cottonseed meal	10
Johnson grass hay	17
Alfalfa hay	15

(4) All feeds were put through a hammer mill and blended in a power mixer. Feed mixture self-fed.

(5) Fourteen late weaned calves were started on test late and are not included in these figures.

Slaughter Data on Part of Cattle in Previous Table

Calves raised and owned by Texas Station. 1950-51.

Line or group designation	Unregistered Herefords	F_1 Hereford x Brahman
Breeding:	Hereford	Brahman
Sex	Steers	Steers
No.	19	54
Animals slaughtered:		
Av. age at slaughter	396	377
Av. slaughter weight	784	788
Av. slaughter grade	16	16
Av. dressing percent	61.8	64.3
Av. carcass grade	11.8	12.7

PERFORMANCE OF COW HERDS. 1951 CALVES

Texas Station

Line or group designation Location	Registered Herefords Bluebonnet	Registered Brahman Bluebonnet	Testers Bluebonnet	F_1 Bluebonnet
Breed of sire	Hereford	Brahman	Hereford	Brahman
Breed of dam	Hereford	Brahman	Unregistered Hereford	Unregistered Hereford
No. cows bred	22	12	67	188
No. cows calving	19	8	54	168
No. calves raised	19	7	48	164
Av. birth wt. (lbs)	62	55	60	78 1/
Av. birth date	Mar. 6	Mar. 25	Mar. 15	Mar. 22
Were calves creep fed?	No	No	No	No
Av. wt. 6 mo.(lbs) 2/	342	351	303	349
Av. weaning date	Nov. 15	Nov. 15	Nov. 15	Nov. 15
Av. weaning weight	447	438	394	482 1/
Av. wean. type score 3/	15.9	16.5	16.7	18.2

1/ Does not include one pair of twin calves raised.

2/ Estimated from weights on 7-18-51 and 10-2-51.

3/ Grades: 8-12 = Choice; 14-18 = Good; 20-24 = Medium.

VIRGINIA STATION

Submitted by C. M. Kincaid, R. C. Carter, A. L. Baker, and B. M. Priode
December 1951

1. Project Title: The Improvement of Beef Cattle for Virginia Through Breeding Methods.

2. Objectives:

   (a) To study the productivity of stocks of beef cattle now used in Virginia.

   (b) To develop methods for estimating the breeding value with respect to type, growth rate and efficiency of young bulls.

   (c) To establish, maintain and develop herds of beef cattle within the pure breeds that will be highly adapted to the Appalachian region, as measured by their ability to utilize grass and rations with limited concentrates, in the efficient production of animals which yield high quality carcasses of desirable type and conformation.

   (d) To estimate the progress to be expected from mass selection as compared with family selection in the improvement of beef cattle.

   (e) To evaluate selection criteria and procedures and develop more precise and effective measures of quality and performance in beef cattle.

   (f) To simplify the methods of progeny or sib testing whereby breeding cattle can be evaluated at comparatively young ages.

   (a), (b), and (c), above, give the objectives of the initial project outline for Virginia started in 1947 at Blacksburg.

   (d), (e), and (f) above, include the objectives of the Cooperative Project Agreement (A.H. 150.16.1) between the Virginia Agricultural Experiment Station and the Bureau of Animal Industry and the Agricultural Research Administration of the United States Department of Agriculture dated March 1, 1950, for co-operative research at the Beef Cattle Research Station, Front Royal, Virginia.

3. Accomplishments during the year:

   (a) Facilities and cattle acquired: Breeding research with beef cattle under S-10 includes herds at three locations, Blacksburg, Front Royal, and Middleburg, with the work at the three stations integrated and handled as a unit. The main general effort in the past year has been to increase females at Front Royal to the capacity of the station. Blacksburg and Middleburg, at the present time, are stocked to the capacity of land and facilities available. A total of 471 cows were bred in 1951, with the number at each location as follows: Blacksburg - 96, Middleburg - 58, and Front Royal - 317. This is a small reduction at Blacksburg and an increase of about 100 head at Front Royal.

Virginia Station (continued)

With the exception of thirteen bull calves and a proven six-year old Hereford bull, increases in the numbers of cattle have come entirely from those raised in the herds. The total number of cattle in the Virginia program, as of December 1, 1951, not including suckling calves, is 725 head. From observation of forage supplies at Front Royal during the past summer, it appears that the number of breeding cows at that station should be increased from here on with caution.

The College purchased 340 acres of land at Blacksburg which had been under lease up to now. While this does not increase the land available to Animal Husbandry, it does make it possible to develop buildings and facilities on a permanent basis.

(b) Research Results:

R. O. P. Testing

There were, on record of performance test in the past year, 27 purebred bull calves, 44 purebred Heifer calves, 30 steers and 39 Grade Heifers. Individual feeding was practiced with each animal in these groups except where pasture was included as part of the testing procedure.

The 27 bull calves (Table B-1) were fed at Front Royal from October 18, 1950 to April 4, 1951. Those not needed for the research program were sold at public auction as one feature of a Field Day held at Front Royal April 11, 1951. An average price per head of $456 was in line with other spring sales of yearling bulls suitable for commercial herds held in the state. Information regarding the weight, gain, and feed consumption of each bull was displayed along with the bull at the time of the Field Day and Sale for the purpose of stimulating interest in the measurement of performance of potential sires. Sires from these R.O.P. bulls needed for research were for the Growth and Type herds in the Shorthorn breed and fast and slow gainers to mate to cows in the Blacksburg test herd. The most promising ones not needed for research herds were mated to purebred cows at Front Royal for progeny tests in a search for foundation sires.

The 43 purebred Heifer calves (Table B-1) were full fed at Front Royal for the period from January 3 to April 4, 1951. They were carried on pasture or roughage with two pounds of grain per head per day from weaning to the beginning of the feeding test. Pasture alone provided the feed for them during the 1951 grazing season. It is proposed to study the relation between gains in the feed lot and on pasture in order to evaluate feeding lot testing as a means of measuring ability to utilize pasture.

The 30 steer calves (Table C) were full fed at Blacksburg from October 13, 1950 to May 14, 1951 -- a period of 212 days. The heritability of rate of gain in the feed lot turned out to be 41 percent when based on the average difference between the fast and slow gainers and 53 percent when based on the regression of average of sire progeny on sire. These estimates are a little higher than the 28 percent found with the first set of steers finished in 1950.

The 39 Grade Heifers (Table D) were roughed through the winter mostly on hay and silage with a small amount of grain and grazed on pasture alone from April 25 to October 13, 1951. They were used in a winter feeding test in which each sire progeny was divided in half with one half fed at maintenance and the other receiving the maintenance ration and three pounds of grain per head per day. The winter gains shown in the table are the average of the two groups. The pasturage furnished these heifers in the summer was in a grazing experiment in which the forage may not have been as good quality as that of some of the better pastures in the area where they were grazed. It is believed that gains were not as large as they would have been had these heifers been on better quality pasture. The regression of average daily gain from pasture of sire progeny on gain of the sire in the feed lot was 0.10 which gives an estimate of the heritability of average gain amounting to 20 percent.

In the report for 1950 it was pointed out that differences in weight accounted for a large fraction of the variability in feed consumption. This same thing holds for the animals full fed on R. O. P. tests concluded in 1951. The pure bred bulls and heifers fed at Front Royal show highly significant regressions for feed consumed on weight. Adjustment of feed consumed for differences in weight reduced the variance of feed consumption by 51 percent for the heifers and 72 percent for the bulls. This regression for the steers fed at Blacksburg was not significant and accounted for only five percent of the total variance of feed consumption. Differences in weight among the steers, however,were much smaller than was the case for either the bulls or the heifers.

Foundation Herds

The foundation herds in the Shorthorn breed (Table E, herds A1, B1, and A2, B2, and A3, B3), were continued with the fastest gaining Shorthorn R.O.P. bull used in the Growth (A2-B2) herd and the one considered by a committee as the best type in the Type (A3-B3) herd. Their respective gains were 2.52 and 2.47 pounds per day as compared with 2.05 for all R.O.P. Shorthorn bull calves. The one used in the Growth herd was purchased and the other one was raised in the herd at Front Royal.

Progress was made toward getting a set of foundation females in the Angus breed ffom an Eileenmere bull belonging to the Middleburg Station. This bull now has in all, 21 daughters born in 1951. His calves look promising and he was used again in 1951 with the expectation that 30 daughters would be available for the establishment of foundation herds from calves born in 1951 and 1952.

A six-year old proven Hereford bull was purchased and used rather extensively in 1951 to obtain a set of daughters for foundation herds in the Hereford breed. If his progeny are satisfactory he will be used again in 1952 on sufficient cows to obtain in all about 30 daughters from him.

Test of Nicking

The heifers purchased to establish a purebred herd of Aberdeen-Angus cattle at the Middleburg Station were in sets of six or more half-sibs from eight different sires. Half of each sire progeny was mated to an Eileenmere bull (prospective foundation sire) and the other half to an Epponian bull. Calves from these matings were born in the fall of 1951. The same two bulls are being used again in the herd with the cows mated to each bull in the first

year switched to the other in the second year. This should provide some measure of the interaction of sire with sets of half-sibs.

Measurement of Performance

All calves in the herds at Front Royal and Middleburg are given type ratings at birth, at about three months of age, at weaning, and as yearlings. These type ratings are combined with weight for age to obtain an index which gives the same importance to type and weight for age. The index is used as a basis for evaluating animals where selections are made. This index is the same as that proposed by the committee on methods of measurements except that the average weights of the calves at specified ages are used rather than those proposed in the original table. Available data from all three Virginia Stations will be studied in the next year in order to set up tables for figuring indexes on the same basis from year to year.

4. Future Plans:

Record of performance testing of bulls, heifers, and steers will be continued. If the results of dry lot feeding of steers sired by fast and slow gaining bulls is similar to that of former years, it is likely that steer testing will be revised to include tests on pasture as well as in the feed lot. The results of the R.O.P feeding of heifers followed by tests on pasture alone may be useful in determining how to test for performance on pasture.

The numbers of breeding cows in the program will expand slowly from here on. One group of Aberdeen-Angus cows now at Front Royal on a share basis will be removed from the program in 1952. They will be replaced by heifers raised from the experimental herds.

Progeny testing of young sires will be continued in an attempt to locate foundation sires and to obtain data on progeny and sib testing.

The prospective foundation sire in the Hereford breed and also the one in the Angus breed will be used sufficiently to assure a minimum of 30 daughters. Arrangements have been made for the use of a very promising young sire now owned by the College which may develop into a foundation sire in the Angus breed. His progeny will be tested for performance.

Plans are under consideration for the development of the Angus herd at Middleburg as a herd selected for performance from pasture. Since this is a pasture station, it may offer unique opportunities for the development of methods of measuring performance on pasture.

5. Publications:

Kincaid, C. M.
The Influence of Winter Feeding on Carcass Weight of Pasture Fattened Steers. Virginia Agricultural Experiment Station, Blacksburg, Virginia.

6. Publications Planned:

Results will be published as the progress of the work justifies.

POSTWEANING PERFORMANCE OF 1950 CALVES FULL FED AFTER WEANING
Bulls and Heifers Individually Self-fed at Front Royal

Virginia Station

Table B-1

I. Bulls (fed 168 days beginning at weaning Oct. 18, 1950)

Breed*	Shorthorn	Angus	Hereford	All breeds	Note on bulls:
No.	5	8	11	24	Data ommitted from
Av. weaning wt.(initial)	488	456	444	457	2 Shorthorn and 1
Av. final wt.	864	808	770	802	Angus removed during
Feed per cwt. gain (lbs)					trial due to founder.
Concentrates	673	661	628	650	
Roughage	114	119	101	110	
Av. daily gain on test	2.24	1.99	1.96	2.06	
Av. type score 12 mon.	10.8	10.6	11.2	10.9	

II. Heifers (fed 97 days beginning Jan. 3, 1951)

Breed*	Shorthorn						Hereford	Angus
Line or group designation	Line A	Line A	Line B	Test A	Test B	Test C		
Sire	492	440	463	663	671	593	3 and 111	H.G. 44
No.	7***	2	10	5	3	7***	8	1
Av. inbreeding (%)	12	16	8	8	8	10	0	0
Av. initial wt. (lbs)	476	374	416	414	408	377	350	371
Av. final wt. (lbs)	632	584	595	574	572	546	522	542
Feed per cwt. gain (lbs)								
Concentrates	810	687	682	812	712	699	618	686
Roughage	155	105	127	165	123	130	93	116
Av. daily gain on feed	1.61	2.16	1.85	1.64	1.69	1.74	1.78	1.76
Av. type score 12 mon.	13.3	12.9	11.5	11.8	11.3	10.0	10.4	9.4
Av. summer gain**	70	122	76	127	93	116	164	141

* Part of the bulls of each breed were selected from those raised at Front Royal and part were purchased. All heifers raised on station.

** During summer of 1951 after termination of feedlot test.

*** One heifer removed during test.

POSTWEANING PERFORMANCE OF 1950 CALVES FULL FED AFTER WEANING
Hereford Steers Fed in Progeny Tests of High and Low Gaining Bulls, Blacksburg

Virginia Station

Table C

Line or group designation	High 1 B - 27	High 1 B - 21	Low 1 F - 102	Low 1 F - 84	High 2 R - 56	High 2 C - 89	Low 2 V - 727	Low 2 C - 102	Summary
Steers									
No.	4	3	4	4	4	4	3	4	30
Av. weaning wt.	460	507	470	471	410	407	402	409	443
Av. 12 month wt.	735	773	737	661	720	681	640	695	705
Length of feeding period*									
Feed per cwt. gain (lbs)									
Concentrates	719	768	725	800	699	757	759	694	738
Roughage	236	243	272	320	215	279	260	266	262
Av. daily gain on test	1.88	1.88	1.87	1.53	1.84	1.72	1.64	1.78	1.77
Av. type score (weaning)**	11.9	12.2	12.0	11.8	11.7	11.0	12.9	11.8	11.9
Av. slaughter grade**	13.8	14.4	13.9	13.9	13.9	13.1	14.7	12.5	13.7
Av. carcass grade**	12.4	13.3	12.7	11.9	12.1	13.2	13.0	11.7	12.5

* All calves put on feed at weaning and individually self-fed a grain mixture and hay free-choice for 212 days.

** Grading system used in Virginia report. Med. = 6-8; Good = 9-11; Choice = 12-14.

PRODUCTION AND/OR SLAUGHTER DATA ON YEARLING AND OLDER CATTLE
NOT INCLUDED IN BREEDING HERDS IN 1951.
Hereford Heifers Produced in Progeny Tests of High and Low Gaining Sires, Blacksburg

Virginia Station

Table D

Line or group designation Sex:	High 1 B - 27 Female	High 1 B - 21 Female	Low 1 F - 102 Female	Low 1 F - 84 Female	High 2 R - 56 Female	High 2 C - 89 Female	Low 2 V - 727 Female	Low 2 C - 102 Female	Summary
No.	4	4	4	8	4	4	7	4	39
Av. age (fall 1950)	223	224	202	212	193	200	187	186	203
Av. wt. (fall 1950)	461	509	405	467	382	350	321	354	406
Av. winter gain*	34	8	6	25	16	59	55	65	34
Days on pasture	171	171	171	171	171	171	171	171	171
Av. gain on pasture	241	260	261	240	285	227	234	223	245
Av. wt. adjusted to 18 mo.	674	702	644	684	675	612	621	635	656
Feeder grade at 6 months	11.7	11.3	10.8	11.9	10.8	11.1	10.9	11.8	11.3
Feeder grade at 18 months	11.1	10.6	11.6	10.7	12.1	10.7	12.0	10.5	11.2
Av. slaughter grade	8.5	8.7	8.2	8.0	9.4	7.4	8.8	7.7	8.3

* Winter gain is considered as gain from weaning October 13, 1950 to the beginning of the pasture season April 25, 1951. Actually they were on pasture with a small amount of grain from weaning to December 1 when winter feeding was started.

PERFORMANCE OF COW HERDS. 1951 CALVES
Shorthorns at Front Royal

Virginia Station

Table E

Line or group designation	Closed Lines		Selection Lines		Test	Randomized Test Herds		
	A_1	B_1	Growth**	Type***				
Breed and no. of sire	Sh.552	Sh.671	Sh.552	Sh.440	Sh.2586226	Sh. 03	Sh. 727	Sh.25T44
Breed of dam	S'horn	S'horn	S'horn	S'horn	S'horn	S'horn	S'horn	S'horn
No. cows bred	16	16	16	16	4*	12	12	12
No. cows calving	3	7	8	10	2	8	8	7
No. calves raised	3	7	6	7	2	5	7	7
Av. inbr., dams (%)	9	9	12	8	9	9	5	7
Av. inbr., calves (%)	22	22	14	12	0	0	8	0
Av. birth wt. (lbs)	68	67	70	74	58	66	67	67
Av. birth date	Feb. 18	Mar. 6	Mar. 22	Mar. 11	Apr. 14	Mar. 29	Mar. 22	Mar. 21
Were calves creep fed?	No	No	No	No	No	No	No	No
Av. wt. 6 mon. (lbs)	346	390	392	323	262	351	347	370
Weaning date	Oct. 11	Oct. 11	Oct. 11	Oct. 11	Oct. 11	Oct. 11	Oct. 11	Oct. 11
Av. weaning wt. (lbs)	373	425	400	342	260	358	359	388
Av. weaning type score	9.7	11.9	11.5	10.1	8.8	11.1	11.4	11.8

* Included two test cows, a cow from the B_1 group, and a cow from the type herd.
** Cows of A_2 and B_2 groups. *** Cows of A_3 and B_3 groups.

PERFORMANCE OF COW HERDS. 1951 CALVES
Angus and Hereford Herds at Front Royal

Virginia Station

Table F

Line or group designation	Angus Increase Herds				Hereford Increase Herds		
Breed and no. of sire	Ang. 66	Ang. H-219	Ang. 19	Ang.K.B.21st	Here. 11	Here. 13	Here. E-9 (polled)
Breed of dam	Angus	Angus	Angus	Angus	Here.	Here.	Here.
No. cows bred	10	10	10	29	38	37	24**
No. cows calving	9	8	7	23	32	31	14
No. calves raised	9	8	6	18*	28	29	12
Av. inbreeding	All outbred matings				All outbred matings		
Av. birth wt. (lbs)	62	67	60	59	71	64	61
Av. birth date	Feb. 21	Mar. 19	Mar. 26	Mar. 10	Apr. 11	Apr. 17	Apr. 18
Were calves creep fed?	No	No	No	No	No	No	No
Av. wt. 6 mo. (lbs)	403	394	407	371	359	333	317
Weaning date	Oct. 12	Oct. 12	Oct. 12	Oct. 12	Oct. 10	Oct. 10	Oct. 10
Av. weaning wt. (lbs)	477	416	432	422	351	322	309
Av. weaning type score	12.1	11.9	12.0	12.9	10.2	11.4	10.4

* Two calves by accidental mating to Hereford bull not included.

** All two-year-old heifers. Bred at Blacksburg, calved at Front Royal.

PERFORMANCE OF COW HERDS. 1951 CALVES

Virginia Station

Table G

Line or group designation Location	High 1 (Asp) Blacksburg	High 2 (Ad) Blacksburg	Low 1 (B) Blacksburg	Low 2 (H) Blacksburg	High 3 (O) Blacksburg	Low 3 (P) Blacksburg
Breed of sire	Angus	Angus	Angus	Angus	Hereford	Hereford
Breed of dam	Gr. Here.	Gr. Here.	Gr. Here.	Gr. Here.	Gr. Here.	Gr. Here.
No. cows bred	12	12	12	12	12	12
No. cows calving	12	10	9	11	9	12
No. calves raised	12	10	9	11	9	11
Av. birth wt. (lbs.)						
Male	72	78	69	77	80	77
Female	68	73	63	69	79	74
Av. birth date	Mar. 22	Feb. 26	Mar. 13	Mar. 12	Mar. 15	Feb. 28
Were calves creep fed?	No	No	No	No	No	No
Av. wt. at 6 mo.						
Male	388	433	396	406	393	406
Female	352	398	269	384	383	397
Av. weaning date	Oct. 12	Oct. 12	Oct. 12	Oct. 12	Oct. 12	Oct. 12
Av. weaning weight	413	468	401	439	420	460
Av. weaning type score	11.6	12.2	11.2	11.2	12.4	11.4
Av. weaning condition score	10.9	11.4	10.4	10.5	11.8	10.9

PERFORMANCE OF COW HERDS. 1951 CALVES (cont'd)

Virginia Station

Table G (cont'd)

Line or group designation Location	High 4 (T) Blacksburg	Low 4 (R) Blacksburg	High 5 (641) Blacksburg	Low 5 (639) Blacksburg	Summary of Progeny in test at Blacksburg High	 Low
Breed of sire	Hereford	Hereford	Shorthorn	Shorthorn		
Breed of dam	Gr. Here.	Gr. Here.	Gr. Here.	Gr. Here.		
No. cows bred	12	12	12	12	60	60
No. cows calving	12	9	11	10	54	51
No. calves raised	12	9	11	10	54	50
Av. birth wt. (lbs.)						
Male	67	76	71	73	73	75
Female	65	71	67	68	71	69
Av. birth date	Mar. 3	Mar. 16	Mar. 26	Mar. 18	Mar. 13	Mar. 7
Were calves creep fed?	No	No	No	No		
Av. weight at 6 mo.						
Male	320	336	361	361	380	381
Female	336	358	344	339	363	350
Av. weaning date	Oct. 12	Oct. 12	Oct. 12	Oct. 12	Oct. 12	Oct. 12
Av. weaning weight	390	379	379	376	413	409
Av. weaning type score	12.5	11.6	12.9	13.1	12.3	11.5
Av. weaning condition score	12.2	11.3	11.6	12.0	11.7	10.9

S-10, IMPROVEMENT OF BEEF CATTLE FOR THE SOUTHERN REGION THROUGH BREEDING METHODS

Report of

Annual Meeting S-10 Technical Committee

Held at Stillwater, Oklahoma

July 21, 22, 23, 1952

State Experiment Stations of Alabama, Arkansas, Georgia, Florida, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia in cooperation with the Bureau of Animal Industry, Agricultural Research Administration, U. S. Department of Agriculture. This report is intended for the use of administrative leaders and workers in developing the program and is not for general distribution.

TABLE OF CONTENTS

TECHNICAL COMMITTEE MEETING PROGRAM
Beef Cattle Breeding Research NC-1 and S-10
July 21, 22, and 23, 1952
Stillwater, Oklahoma

July 21 - Chairman - L. N. Hazel

9:00 AM Remarks. President O. S. Willham, Oklahoma A. & M. College

9:30 Summary of Beef Breeding Projects
1. Reports by Johnson, Warwick and Roubicek
NC-1, S-10 and W-1 respectively
2. Question period

10:30 Interpretation of Individual Feeding Data - Panel Discussion
Warren Gifford, Arkansas - Chairman

L. E. Johnson, Nebraska
C. M. Kincaid, Virginia
W. H. Smith, Kansas
C. A. Dinkel, South Dakota
R. E. Patterson, Texas
J. E. Foster, Maryland

12:00 M Lunch

Chairman - H. A. Stewart

1:00 PM Detailed Carcass Studies in a Breeding Program
L. E. Kunkle, Ohio
B. L. Warwick, Texas

2:00 Developing Selection Indexes - A discussion on the working level with mimeographed example - L. N. Hazel, Iowa

3:00 Measuring the Amount of Selection Practiced -
G. E. Dickerson, Missouri

4:00 Identifying Dwarf Carriers with a Profilometer -
New evidence and demonstration - P. W. Gregory

5:00 Inspection of College Beef Herd at Stillwater.

July 22 - Chairman - Doyle Chambers

8:00 AM Tour of Swine Breeding Project at Stillwater

10:00 Leave for Fort Reno

1:00 PM Tour of Projects at Fort Reno and Discussion of same by Oklahoma staff.

8:00 PM Beef Cattle in Hawaii - R. T. Clark, National Coordinator

July 23 - Chairman - M. L. Baker

8:00 AM Cooperative Animal Breeding Research -
L. E. Hawkins, Oklahoma
Cooperative Animal Breeding Research -
T. C. Byerly, Bureau of Animal Industry
How Can We Better Finance Cooperative Research Projects Through State and Federal Funds -
H. C. McPhee, Bureau of Animal Industry
Conclusions - R. T. Clark, Bureau of Animal Industry

9:30 NC-1 and S-10 Business Meetings

12:00 M Adjournment

Persons in attendance:

Alabama	Keith E. Gregory*
Arkansas	Warren Gifford*, C. J. Brown
Georgia	B. L. Southwell*
Florida	Marvin Koger*, W. G. Kirk
Louisiana	Richard A. Damon, Jr.*
Maryland	J. E. Foster*
Mississippi	C. E. Lindley*
North Carolina	H. A. Stewart*
South Carolina	E. G. Godby*
Tennessee	C. S. Hobbs*, H. J. Smith, J. H. Carrier
Texas	B. L. Warwick*, T. C. Cartwright, H. O. Kunkel, J. C. Miller, L. A. Maddox, Jr.
Virginia	C. M. Kincaid*, R. C. Carter

R. E. Patterson	Regional Advisor S-10, College Station, Texas
E. J. Warwick	Regional Coordinator S-10, Knoxville, Tennessee
R. T. Clark	National Coordinator, BAI, Denver, Colorado
Hugh C. McPhee	BAI, Washington, D. C.
T. C. Byerly	Chief, AHD, BAI, Beltsville, Maryland
J. O. Grandstaff	Office of Experiment Stations, Washington, D.C.
B. M. Priode	Front Royal Station, Virginia - BAI
E. H. Vernon	Jeanerette Station, Louisiana - BAI
M. W. Hazen	Bluebonnet Station, Texas - BAI
Harry Gayden	Exec.ut.Secretary, American Brahman Breeders Assn.
Lloyd Miller	American Aberdeen Angus Assn.

* Technical Committee members.

July 21, 1952 - Morning Program - L. N. Hazel, Chairman

L. N. HAZEL - Gentlemen, the first man on our program is a man brought up in our own field of training. He has recently deserted us, but I know he still has a very deep interest in animal breeding. I wish to present Dr. Oliver S. Willham, President of Oklahoma A. & M. College.

REMARKS

Dr. Oliver S. Willham

Dr. Hazel and friends. I feel just a little out of place making a talk to you animal breeding specialists. It has been some time since I have been active in your field. In a rapidly-growing field such as yours, it is easy to get out of date. I know that I must no longer consider myself an authority on animal breeding, regardless of my training. I left the field of animal breeding to enter my present field, as the call for my services at our institution seemed to be always toward administration and away from animal breeding. But every day that I put in on my new job I feel just a little bit like the parrot that a lady bought in a pet shop. The parrot was beautiful but the language of the bird was not quite proper for the living room. The lady told the parrot that if he didn't improve his language she would wring his neck. She came in the next morning and sweetly said, "Nice morning, isn't it?" The parrot answered with "It's a Hell of a fine morning". Immediately the lady picked up the parrot and gave his neck a good wringing. She walked out of the room and returned in a few minutes. Again she repeated very sweetly, "Nice morning, isn't it?" Surprised, the parrot said, "Where in the Hell were you when that cyclone struck?" In my new position I often find myself feeling like that parrot.

I would like to welcome you people first to our state, Oklahoma, which is about as old as most states and yet is still a very young state. Oklahoma was first explored about 1540; thus we are not too young. We also had the French explorers here in 1719, but we didn't become a state until 1907. The first white settlement began in 1796 while the state was still Indian Territory. From 1824 to 1874 the white settlements were organized into forts. Two of the last forts to go out of operation in Oklahoma were Fort Reno and Fort Gibson. Farming was started in Oklahoma in 1889 when a series of land openings were begun. These land openings lasted from 1889 to 1901 and most of the settlement took a period of about 12 to 14 years. We are not an old state from the standpoint of having been farmed over a long period of time. We have been blessed well in mineral resources. We rank high in agricultural production of beef cattle. In recent years we have also ranked high in grain sorghums, wheat, alfalfa. We have much at stake in beef cattle raising. We have a professional and financial interest in the improvement of beef cattle through breeding.

Dean Blizzard and his associates have served the state of Oklahoma well in the development of commercial and purebred livestock production. Our livestock numbers have grown rapidly during the past decade. We have good herds of beef cattle, swine and sheep. We do, however, want still better ones. This is especially true in our beef cattle enterprise.

We are interested in the work that you people are doing. We do not expect any miracles in the immediate future, but it is heartening to see your program started. I believe you are going to get somewhere, but your results are going to come slowly. You will have many obstacles but at least you will not have the opposition of the church which Robert Bakewell had. We do, indeed, have a difficult job in beef breeding research. You have the job of work plus keeping the public satisfied while they are waiting for results. There is a painting over the front entrance of the Mellon Institute which shows an old ragged man with a stick over his shoulder and on the stick is a red handkerchief which holds all of his belongings. When asked about this painting, the Director of the Institute said that it was one of the early donors waiting for some of the results to be put out from the institution.

In your breeding work you must know what is and will likely be demanded by the public in beef production, and develop methods of producing such beef economically. Satisfying the public which is changing its mind rapidly only makes your job that much more difficult. Our accepted type of cattle is different at the present time from the accepted type of several years ago. Likely the accepted type of tomorrow will be different from that of today.

We must also breed to meet the increased tonnage demanded by our ever-growing population. Our present increase in the population of the United States and the World demands that we produce a more efficient animal or use other food in our diet; thus we are going to have to keep our animals efficient.

We are doing this work in a period of both handicap and advantages. We are short of money, men, and facilities, but we are working in a world that has made a lot of progress in the last decade and expects more in the near future. During the recent war periods we have made a lot of progress in all fields of production and probably more than in the last preceding twenty or thirty years. We find our people ready for a change. We do not have to sell our new facts; people are asking for them. All over the World it is the same. Never before has it been easier to get new production facts into operation. The ball is already rolling. It is up to us to continue it and guide its travel. It is a lot easier to guide a rolling ball than to start a stationary one. We must get new facts and use them. One of the things that has made this country great is that we have been a nation that has been willing to put everything into use for the human race. We don't put new ideas up on the shelf for 35 or 50 years. The spirit of search is still with us in our work in spite of the national and international situation. We can go forward with real research in our beef breeding investigations and I know you will do so.

Justice Douglas has said that one of the greatest difficulties of this country is that we no longer have the spirit of '76. Then three million people gained their independence from a vastly superior nation in numbers and equipment. Today we have 154 million people possessing untold facilities, and yet we are afraid. We have increased agricultural production 25% during the last ten years. Our industrial production is equally as good. We have no reason to be afraid, and each piece of good research puts us on a much sounder basis for better living.

Most lacking in the field of research is good promotion of public relation activities. In agriculture we suffer for not keeping the public better informed. The average individual in town would say beefsteak is the highest-priced article he has to buy, and is higher than it ever has been in history. The fact is that in the past, one hour of labor would buy one pound of beefsteak; now one hour of labor will buy one and one-half pounds of beefsteak. Is beefsteak higher than in the past? I suggest that we learn to use the English language and explain our work. A young man once went away to school and became a genealogist. When he graduated he was broke and needed work badly. He started looking for a client and found one in a rich old lady. The young man worked very hard on tracing her family tree. The closing sentence of his report was, "And Aran, the youngest son was electrocuted at Sing Sing". The old lady was simply outraged and said that she wouldn't accept the report. The young man was very unhappy and went home to think of some way of persuading the old lady to accept the report. He returned the following day with a revision that was acceptable to the lady, and this is what it said: "And Aran, the youngest son, occupied the seat of applied electricity in one of the best-known institutions of our nation, and died in the harness". Let us explain our work as effectively.

I have stayed out of the animal breeding field because I am out of date. In one of our insane asylums, one of the inmates was trying to help get the building cleaned up for inspection, and when the inspectors came they found him painting a wall. They asked him what he was painting and he said, "The Children of Israel going through the Red Sea". "Well," they said, "where is the sea?" He said that the sea had opened back and you couldn't see it. "Well, where are the Children of Israel?" The inmate answered, "They have already gone through the opening". The visitors then asked where were the Egyptians. The inmate replied that they hadn't caught up yet, and that is the way I am in the field of animal breeding.

We are glad to have you here and hope your stay will be pleasant, and I am sure our staff will show you the work we are doing here.

Dr. Craft is back with us. We still claim him, and are happy that he can be here. We are also happy to have Dr. McPhee with us. Dr. McPhee has done much to make our cooperative work in animal breeding successful since its inception.

L. N. HAZEL - Thank you, Dr. Willham, for your words of welcome and wisdom. We will try to keep them in mind as we develop our program during the coming years.

It is becoming more and more clear that we really do not know all the answers in working together effectively in cooperative research, but we are learning. A certain aspect of the research is having to transcend state interests. I think this is good, as it makes us all realize that biological laws do not recognize state or national boundaries. I believe we will all gain from our joint NC-1 and S-10 meeting.

I would like to appoint a nominating committee for NC-1. The nominating report will be called for at our business meeting. The committee will consist of G. E. Dickerson, Chairman; Doyle Chambers and R. J. Webb.

Dr. L. E. Johnson will now present a summary of the NC-1 project.

THE STATUS OF BEEF CATTLE BREEDING WORK IN THE NORTH CENTRAL REGION

Leslie E. Johnson

The objective of NC-1 is the improvement of beef cattle through breeding. The projects have all been designed to discover, develop, and test breeding methods and procedures that can be used by beef producers to produce quality beef economically. Special emphasis is being devoted to determine (1) effectiveness of selection in improving economically important characters, (2) usefulness of inbreeding, outbreeding and crossing in beef production, (3) relationship between over-all performance and its component parts such as size, conformation, rate of gain, economy of gain and fertility, (4) relationship between live animal measurements, carcass measurements and carcass worth, (5) size and importance of environmental and genetic relationships in production characters of beef cattle, (6) value of existing experimental lines in beef production, and (7) methods of elimina ting inherited defects from existing beef cattle. It is anticipated that some good cattle will be developed in the work, but new breeding facts are the goal of the investigations.

Size of Project

The Bureau of Animal Industry and Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota and Wisconsin have signed memorandums of understanding for conducting cooperative beef breeding research in NC-1. Ten of these states have active projects in operation.

Cattle in NC-1 are now located at the following experiment stations:

Illinois - - - -	Dixon Springs Experiment Station, Robbs
Iowa - - - - - -	Ankeny Farm, Ankeny
Kansas - - - - -	Agricultural Experiment Station, Manhattan
	Ft. Hays Branch Station, Hays
Michigan - - - -	Agricultural Experiment Station, East Lansing
	Lake City Experiment Station, Lake City
Minnesota - - -	University Farm, St. Paul
	West Central Experiment Station, Morris
	Northwest Experiment Station, Crookston
Missouri - - - -	Agricultural Experiment Station, Columbia
	Weldon Springs Station, Weldon Springs
Nebraska - - - -	Agricultural Experiment Station, Lincoln
	North Platte Substation, North Platte
	Beef Cattle Research Station, Fort Robinson

Ohio - - - - - - Agricultural Experiment Station, Wooster
Oklahoma - - - - Ft. Reno Experiment Station, El Reno
South Dakota - - Agricultural Experiment Station, Brookings
Cottonwood Range Livestock Station, Cottonwood
Antelope Range Livestock Station, Buffalo
Reeds Ranch, Presho

A summary of the cattle on hand as of June 30, 1952; animals fed on performance tests during 1951-52; additions in physical equipment during 1951-52; and money expended during 1951-52; is given in Tables 1, 2, 3, and 4.

Table 1 - CATTLE INVENTORY OF BREEDING HERDS OF NC-1 PROJECTS AS OF JUNE 30, 1952.

State	Line No.	Bulls 12 mo.+	Cows 2 yr.+	Hfrs. Yr.	Calves Male	Calves Hfr.	% Use for NC-1.	Value Chg. to NC-1
A. PUREBRED HEREFORDS								
Illinois	FG	1	18	7	4	8	100	8750
	EF	1	17	8	8	8	100	9100
	Control	5	39	7	10	8	100	17250
Iowa	5	1	0	10	0	0	100	5000
Kansas	Man.	7	36	10	9	11	10	1800
Michigan	1	1	7	1	3	2	100	5000
	2	1	8	0	3	1	100	5000
	3	1	7	0	2	1	100	5000
Missouri	W.Sp.	4	53	7	14	28	100	25650
Nebraska	FR 1	2	25	0	8	10	100	14275
	FR 2	9	31	8	10	13	100	6800
	FR 4	7	22	4	9	11	100	9300
	FR 5	8	20	6	9	7	100	10200
	FR 6	3	10	15	3	6	100	13650
	FR 7	11	31	5	3	2	100	17900
	FR 8	9	30	8	6	8	100	18650
	FR 9	5	39	8	18	6	100	22000
	FR 10	9	50	6	6	13	100	26650
	FR 11	2	48	0	0	0	100	19200
	NU 1	12	33	11	14	10	100	24700
	NU 2	11	30	8	12	7	100	17300
	NP 3	6	42	15	6	6	100	24125

Table 1 Continued

State	Line No.	Bulls 12 mo.+	Cows 2 yr.+	Hfrs. Yr.	Calves Male	Calves Hfr.	% Use for NC-1	Value Chg. to NC-1
Oklahoma	2	3	29	3	10	15	100	13,800
	3	3	24	0	12	9	100	15,300
	4	0	24	0	2	9	100	11,800
South Dakota	P	1	21	9	6	7	100	9,910
	O	1	12	3	4	4	100	5,660
	PM	3	16	11	3	3	100	10,120
	T	2	12	0	2	3	100	5,750
	A	1	9	2	3	3	100	4,420
	N	2	22	3	9	8	100	10,190
	FH	1	17	7	6	6	100	8,240
	TR	2	19	5	7	6	100	9,410
	M	2	23	2	5	6	100	9,870
	H	1	9	0	2	3	100	3,950
TOTAL	35	138	833	189	228	248	97.4	430,720

B. PUREBRED ANGUS

Iowa	1	1	9	4	4	1	100	7,000
	2	1	8	4	5	2	100	6,500
Kansas	Man.	2	36	9	14	11	10	2,000
Michigan	Mich.	1	9	6	2	0	100	7,500
Nebraska	FR 3	2	25	0	9	9	100	13,800
	FR 12	0	2	16	0	0	100	5,400
	NU 3	9	24	7	7	9	100	16,900
Oklahoma	1	4	29	1	11	6	100	16,800
TOTAL	8	20	142	47	52	38	88.7	75,900

C. PUREBRED SHORTHORNS

Iowa	3	1	11	2	2	2	100	7,000
Kansas	WP	5	18	6	7	6	100	9,000
	Mer.	3	17	10	4	6	100	8,450
Minnesota	Mer.	4	49	21	14	24	100	39,750
Nebraska	NU 4	6	30	1	11	8	100	17,000
TOTAL	5	19	125	40	38	46	100	81,200

Table 1 Continued

State	Line No.	Bulls 12 mo.†	Cows 2 yr.†	Hfrs. Yr.	Calves Male	Calves Hfr.	% Use for NC-1	Value Chg. to NC-1
D. GRADE HEREFORD TEST HERDS								
Illinois	1	0	44	0	0	2	50	6,700
	2	3	62	0	31	27	50	14,950
	3	3	67	0	26	18	50	15,125
	4	1	28	0	9	10	50	6,250
	5	4	0	48	0	0	100	7,600
Kansas	Ft.H.	5	126	59	65	60	100	60,000
Michigan	1	0	6	1	4	2	100	2,500
	2	0	5	2	2	2	100	2,500
	3	0	6	2	3	2	100	2,500
Missouri	W.Sp.	0	33	3	13	9	100	9,250
Ohio	1	6	0	60	0	0	100	18,000
South Dakota	Reeds	2	30	6	11	12	50	5,675
	Ctr.	3	48	12	12	11	50	9,090
TOTAL	13	27	455	193	176	155	76.9	160,140

Table 2. YOUNG ANIMALS FED IN PERFORMANCE TESTS IN NC-1 DURING 1951-52

State	Herefords			Angus			Shorthorns		
	Bulls	Hfr.	Steers	Bulls	Hfr.	Steers	Bulls	Hfrs.	Steers
A. PUREBREDS									
				Individually Fed					
Illinois	15								
Iowa				3	7		2	2	1
Kansas							4	16	4
Michigan	8			3					
Minnesota							4	18	6
Missouri	12								
Nebraska	73	73		9	27		6	2	
Oklahoma	11	13		12	3				
South Dakota	38								
Total	157	86		27	37		16	38	11
				Group Fed					
Illinois		22	4						
Nebraska	11	16							
Total	11	38	4						
B. GRADES									
				Group Fed					
Illinois			60						
Kansas		119	128						
Ohio	12	60	24						
Total	12	179	212						
GRAND TOTAL	180	303	216	27	37	0	16	38	11

Table 3. VALUE OF LAND AND PHYSICAL FACILITIES ADDED TO NC-1 PROJECTS DURING 1951-52

State	Value
Illinois	495
Iowa	12,500
Kansas	6,200
Michigan	1,950
Minnesota	80
Missouri	6,000
Nebraska	18,450
Oklahoma	3,982
South Dakota	3,110
Total	52,767

Table 4. FUNDS EXPENDED ON NC-1 DURING 1951-52 (partially estimated)

	Non-Recurring			Operating		
State	9b3	BAI	Controlled	9b3	BAI	Controlled
Illinois	500			1,500		10,000
Iowa			11,000	4,400	6,000	2,000
Kansas	1,000		5,000	2,000		30,000
Michigan			13,000			4,000
Minnesota			1,655	1,000	1,928	11,945
Missouri	900		5,000	3,000		25,000
*Nebraska			30,000	4,750	2,400	74,000
Ohio			11,300	1,500		22,100
*Oklahoma			6,000	4,400		12,695
South Dakota			3,110	3,900	3,550	13,893
Total	2,400		86,065	26,450	13,878	205,633

*Does not include BAI funds being spent at Ft. Robinson and Ft. Reno.

A careful study of these tables indicates that NC-1 is a going project with sufficient livestock and facilities to begin to answer some of the complicated problems involved in the efficient production of quality beef.

A comparison of the 1951 and 1952 inventories shows that the number of Hereford lines has increased from 30 to 35; the Angus lines have increased from 6 to 8; and the Shorthorn lines have remained at 5. The total number of purebred animals in the project has increased from 1947 to 2203. Grades used in test herds have increased from 798 to 1006. In general, a sizable amount of equipment has been added to the project. State expenditures have been a bove anticipated amounts and federal expenditures have been definitely smaller than anticipated.

General Findings Worth Noting

It appears best to self-feed a grain-roughage mixture when attempting to measure genetic differences in the gaining ability of cattle. A grain-roughage mixture varying from 3:1 to 2:1 appears satisfactory. It is not necessary to vary the ratio when the calves are put on full feed following weaning and fed for a period not to exceed 196 days.

The Nebraska self-feeder has proved satisfactory for self-feeding a grain-roughage mixture. Blueprints may be had by writing the Animal Husbandry Department, University of Nebraska.

Weaning weights should be corrected for age when weaning at a given date. South Dakota and Nebraska have calculated age correction factors for weanling calves.

Age of dam and sex of calf have significant effects on weaning weights, and should be considered in figuring weaning weights. Nebraska has calculated correction factors for these effects in range beef cattle.

Ohio has shown that males castrated at weaning were just as efficient in the feed lot and on the hook as those castrated at one month of age; thus, there is no need to make any male selections in breeding herds until after weaning.

Ohio and Iowa have found that young bulls taken from feeding tests at 15 to 16 months of age yield good carcasses. Many tested bulls should undoubtedly be slaughtered for meat.

Missouri has shown there are enough identical twin beef animals available to use them in a limited way in beef breeding investigations.

South Dakota, Nebraska and others have shown that feed per 100# gain is not a good measure of efficiency when feeding cattle of various ages and weights for a time constant feeding period.

Slaughter data collected according to techniques set forth by the NC-1 Carcass Committee in the minutes of 1951 annual meeting, are satisfactory for evaluating carcasses.

Dwarfism has appeared in NC-1 experimental breeding herds in the Herefords, Angus and Shorthorn lines. It is hampering the accomplishment of the objectives set forth by project leaders. Beef producers are more interested in eliminating dwarfism than in increasing the production efficiency in general in their beef herds. Iowa is establishing a dwarf carrier breeding herd to investigate dwarfism.

Are Beef Breeders in the North Central Region Willing To Pay For Production Tested Bulls?

We are often asked, "Are beef producers interested in producing quality beef more economically? Are they in sympathy with our beef breeding improvement project?" I believe we all have good reasons to believe that they are. It is a little difficult, however, to estimate how much they are willing to pay for the kind of cattle we are trying to breed.

Last year the American Shorthorn Association assembled 102 bulls at Broken Bow, Nebraska, from 45 purebred breeders and fed them together on pasture. They were fed on test for a period of 122 days. At the beginning of the test they averaged 12 months of age. The spread in age was 203 days. They averaged 772 pounds in weight, varying from 548 to 998 pounds when started on test. Data collected on the bulls were (1) age, (2) weight at beginning of feeding period, (3) type at beginning of feeding period, (4) condition at beginning of feeding period, (5) gain during feeding period, (6) final weight, (7) type at end of feeding period (time of sale), (8) condition at end of feeding period, and (9) auction sale price. Ninety-eight of the bulls finished the test and were sold. Buyers were furnished weight and gain records. They were not given our type and condition ratings. An analysis of the data showed the following:

1. For each 100 days additional age a bull made 15 pounds extra gain during the feeding period.

2. For each 100 pounds additional initial weight a bull made 4 pounds less total gain.

3. For each additional 1 grade in type at the beginning of the feeding trial a bull made 23 pounds less total gain.

4. For each additional 1 grade in condition at the beginning of the feeding trial a bull made 38 pounds less total gain.

5. For each additional 1 grade in type with condition held constant, the buyer paid $128.28 extra.

6. For each additional 1 grade in condition with type held constant, the buyer paid $194.07 extra.

7. For each additional 1 grade in type with condition and gain held constant, the buyer paid $141.30 extra.

8. For each additional 1 grade in condition with type and gain held constant, the buyer paid $155.52 extra.

9. For each additional pound of gain with condition held constant the buyer paid $1.26 extra.

10. For each additional pound of gain with type held constant the buyer paid $1.44 extra.

11. For each additional pound of gain with type and condition held constant the buyer paid $1.33 extra.

This study seems to indicate that beef producers are willing to pay for the ability of cattle to gain if they have such information when purchasing their beef sires. For one standard deviation of gain, they paid $80.60 when type and condition were held constant. On the same basis, however, they paid $98.91 for type and $82.94 for condition. The average price of the 98 bulls was $516.73. The top bull sold for $1500 and the bottom bull for $205.

Summary

The greatest need of the NC-1 project is to get present projects into full operation. In general, this involves some expansion in cattle numbers, barns and handling facilities, and a large increase in technical help. This is being accomplished as rapidly as state and federal funds are made available.

Plans for 1952 call for (1) an expansion of work at each of the ten stations with active projects, (2) initiation of work at one new station to strengthen present regional investigations, (3) establishment of two new test herds to evaluate present experimental lines and to assist in developing future breeding projects, (4) some revision of projects to enable more efficient cooperative research, (5) continued collection of data and analysis of same, (6) construction of indexes to guide early selection and investigational work, and (7) development of better production and carcass standards and records.

L. N. HAZEL - Thank you, Dr. Johnson. Dr. Warwick will now give the S-10 report.

THE STATUS OF S-10 BEEF BREEDING WORK

E. J. Warwick

Most of the material presented in the following tables has been assembled from a questionnaire prepared by the S-10 committeemen, in June, 1952. The data should be helpful in grasping the size and scope of S-10. (See Tables 1, 2, and 3.)

Some of the accomplishments of the Southern project, now four years old, are:

1. Analysis of data showing effects of age, sex, and environment on performance factors, under our conditions.

2. Collection and analysis of data on performance of crossbreeding between Brahman and English breeds. The use of Brahman bulls on English cows in the South has resulted in extra weight of calves at weaning.

3. Establishment of heritability values for rate of gain in cattle by feeding bulls, breeding high and low gainers to randomly-selected groups of cows and comparing the differences effected with those reached for. This has been done at the Virginia Station. In 3 years of testing the results have varied, giving values ranging from 28% to 40% as heritability of rate of gain.

4. Establishment of breeding herds to test value of mass selection in the formation of inbred lines.

5. Introduction of germ plasm from South America. This was done through the shipment of semen from South America to the North Carolina Station.

6. Collection and analysis of data determining the importance of milk production in beef cattle production.

In spite of these accomplishments we still have many needs. Some of these are: (1) more experimental breeding herds, (2) better measurement of productivity of our animals, (3) better techniques for measuring productivity, (4) better organization and management of our stations so that we can use a minimum of time, labor and effort in getting accurate results.

I am of the opinion that the time has come when we need to be doing more with our herds than ever before. Critical evaluation of our program with drive for better performance seems needed. The time has come when we will need to have each project better organized to find specific answers. The Southern region has problems greater than some of the other regions. One of these relates to the production of calves for slaughter at weaning -- a common practice in the area. In line with the long term objectives of the various projects, we are attempting to get answers to as many problems of immediate importance as possible.

TABLE 1 - INVENTORY VALUE OF S-10 PROJECTS

	July 1, 1951			July 1, 1952		
	Cattle (total value)	Cattle (adj.for % use)	Land and Equip.	Cattle (total value)	Cattle (adj.for % use)	Land and Equip.
Alabama	29,000	29,000	95,191	43,800	43,800	108,940
Arkansas	112,485	108,555	101,125	118,415	105,162	159,176
Florida						
State Stations	108,345	73,272	69,475	228,850	150,780	176,600
Federal Station, Brooksville	-	-	*	-	48,200	*
Georgia	64,000	47,450	19,500	106,450	75,870	19,500
Louisiana						
State Stations	58,620	47,100	82,775	126,282	126,282	84,190
Federal Station, Jeanerette	-	-	*	74,600	74,600	*
Maryland	44,500	33,375	138,762	50,025	31,319	165,262
North Carolina	125,330	41,229	85,350	132,700	48,175	88,915
South Carolina	54,500	54,500	29,500	59,312	59,312	29,500
Tennessee	122,630	111,275	147,075	180,100	121,525	148,075
Texas	125,175	125,175	418,140	189,600	189,600	433,084
Virginia						
State Stations	71,900	57,700	81,250	70,850	55,675	81,250
Federal Station, Front Royal	107,100	107,100	*	192,550	192,550	*
TOTALS	1,023,585	835,731	1,268,143	1,573,534	1,322,850	1,494,492

*No attempt made to put a value on federal station property.

TABLE 2. NUMBER OF CATTLE OF DIFFERENT AGES IN S-10 PROJECTS AND FEEDING DONE IN 1951-52.

State	Cattle Inventory July 1, 1952*						Cattle Fed After Weaning Under Test Conditions, 1951-52					
	No. females over 1 yr. 7/1/51	Cows 2 yrs. & over	Yr. Hfrs.	Bulls 1 yr. & over	Calves under 1 yr.	% Use on Project	Bulls Fed Group	Bulls Fed Indiv.	Steers Fed Group	Steers Fed Indiv.	Heifers Fed Group	Heifers Fed Indiv.
Alabama	94	38	38	2	-	100	19	-	-	-	-	-
Arkansas	240	171	53	20	105	89	-	20	-	-	42	-
Florida												
State Stations	359	596	141	36	301	65	-	-	9	26	35	1
Federal Station, Brooksville	170	118	9	7	68	100	-	-	-	-	-	-
Georgia	152	183	68	15	154	59	22	-	-	-	50	-
Louisiana												
State Stations	250	222	14	9	64	100	1	-	35	-	-	-
Federal Station, Jeanerette	209	157	36	19	102	100	-	8	32	-	-	-
Maryland**	48	48	11	3	31	64	2	-	1	16	6	9
North Carolina	246	245	106	18	153	36	15	-	18	-	14	-
South Carolina	90	93	-	6	84	100	-	29	-	-	-	-
Tennessee	422	537	109	48	389	66	13	-	27	-	-	-
Texas	344	356	102	24	225	100	345	10	85	-	218	-
Virginia												
State Stations	203	152	46	-	118	82	-	-	-	36	-	44
Federal Station, Front Royal	347	380	67	25	220	100	-	42	-	-	-	45
TOTALS	3174	3296	800	232	2014		417	109	207	78	365	99

*Includes all cattle on each station, whether owned by state, Bureau Animal Industry, or cooperating breeders.
**Does not include cattle in an outside cooperating herd.

TABLE 3. Data Regarding Expenditures for S-10 Beef Cattle Breeding Project Assembled From Information Received on a Questionnaire Circulated to S-10 Technical Committeemen, June, 1952

	Present 9b3 Allotment	9b3 Request if Allotment is: $30,000	9b3 Request if Allotment is: $50,000	Current BAI (10b) Allotment	Fiscal 1954 BAI (10b) Request	Fiscal Expenditures, 1952 State* Capital Outlays	Fiscal Expenditures, 1952 State* Operation	Fiscal Expenditures, 1952 Old-line BAI
Alabama	-	5000	5000	-	10000	26058	22576	-
Arkansas	6500	6500	10800	2400	4000	48530	46791	-
Florida								
State Stations	-	2000	4000	-	6000	34000	52100	-
Federal Station, Brooksville	-	-	-	-	-	-	10000	28000
Georgia	-	-	5000	-	22000	-	15000	1920
Louisiana								
State Stations	-	3000	5000	-	-	51000	13640	-
Federal Station, Jeanerette	-	-	-	-	-	-	27614	32743
Maryland	600	5000	8500	-	12000	43429	17223	-
North Carolina	2500	2500	4000	1500	1500	-	37294	2500
South Carolina	-	5000	5000	-	5000	1250	20275	-
Tennessee	6500	6500	7500	2400	23000	14600	35450	-
Texas	8500	8500	15000	5000	11000	13943	92479	?
Virginia								
State Stations	3200	3200	7500	3600	23600	55000	33440	-
Federal Station, Front Royal	-	-	-	-	-	-	34173	25000
TOTALS	27800	47200	77300	14900	118100	287810	458055	

* Includes state appropriations, receipts, and federal grant funds directly under state control.

In a recent article in Science the statement was made that in large coordinated research projects there was a danger of investigation becoming intrigued with size itself and that routine data collection could supplant creative thinking. This could be true in our field if we do not plan wisely. The advantages that can accrue from the cooperative nature of our beef cattle breeding project, however, appear to make the chance well worth taking, provided we keep this potential danger in mind.

L. N. HAZEL - We will now have the W-1 report presented by Mr. Carl Roubicek.

THE STATUS OF W-1 BEEF BREEDING WORK

C. B. Roubicek

The number of lines, animals and value of such lines in W-1 are given in the following table. This table also includes the amount of feeding work done last year in W-1.

W-1 BEEF CATTLE INVENTORY, JUNE 15, 1952

Purebred Breed	No. of Lines	Bulls 1 yr. or over	Bulls Calves	Females 2 yr. or over	Females Yearling	Females Calves	Value
H	52	322	421	1,369	410	466	$1,220,160
H(P)	7	22	31	72	14	30	73,900
A	6	25	28	101	34	31	135,400
S	4	15	22	85	36	33	74,100
Total	69	384	502	1,627	494	560	$1,503,560
Grade							
H	42	12	183	784	266	-	258,225
H(P)	2	-	-	280	-	-	140,000
Br.Sw.	1	-	-	10	-	-	5,000
X Bred	2	1	1	28	5	-	14,750
Dwarf	3	6	-	9	6	-	3,740
Total	50	19	184	1,111	277		$421,715
Gr. Tot.	119	403	686	2,738	771	560	$1,925,275

FEEDING TRIALS, 1951-1952

Ind.Fed Purebred	Breed	Bulls	Heifers	Steers	Totals
	H	265	61	-	326
	A	16	18	-	34
	S	10	20	-	30
Total		291	99	-	390
Grade	H		12	36	48
Group Fed Purebred	H	4	221	137	362
	A	5	2	10	17
	S	-	-	24	24
Total		9	223	171	403
Grade	H		146	217	363
Gr.Total*		300	480	424	1,204

*Does not include animals fed at the stations for cooperating farmers

Summary of State Contributions to W-1 Project

Facilities	$2,074,867
Livestock	1,925,275
Land (69,428 acres)	1,068,335
Total*	5,068,477

*Includes livestock but not facilities or land at federal stations.

During the past year facilities have been doubled in W-1. We have added one new meat laboratory, a new genetics laboratory in Wyoming, a new genetics and physiology laboratory in Oregon, and general expansion of facilities in California.

One of the coordinator's responsibilities in W-1 is the pooling of data. We are attempting to standardize our data so that it can be combined and published as soon as possible. Our first pooling of data has been with carcass data. It is coming in slowly, but we are making progress.

INTERPRETATION OF INDIVIDUAL FEEDING DATA

Panel Discussion--Warren Gifford, Chairman

WARREN GIFFORD: During the last few years we have been doing a rather large amount of individual feeding in beef breeding research. Some stations have collected enough data that preliminary analyses have been made. This panel wishes to share some of their experiences with you and tell you what they think they are learning from their labors.

C. M. KINCAID: A study of the linear regression of daily feed consumption on weight within breed and age subclasses for bull and steer calves individually fed during a five-year period showed highly significant linear coefficients within sublcasses for four of the five years and within animal for all of the subclasses. After adjustment for linear regression the data also showed highly significant differences among breed and age subclasses for bull calves in two of five years and for sire progenies differences among steer calves for both years they were included. Correlations between rate of gain and efficiency based on (1) observed feed consumption and (2) feed consumption adjusted for regression on weight ranged; for (1) from -.05 to .63 and for (2) from .77 to .88. It appeared from these data that rate of gain was a better measure of efficiency than the ratio of gain to feed consumption unless adjustment was made for differences in weight or that constant end weights were used. The question of the value of individual feeding data as a measure of efficiency is still open for debate. It is hoped that examination of available data, as well as that from more individual feeding trials by other stations, will help to clarify the problem of interpreting individual feeding data. Other factors worth noting in the Virginia feeding tests were (1) a tremendous variation in daily feed consumption; (2) self-feeding a ration in which the roughage and grain were not mixed appeared to result in a higher incidence of founder than when self-feeding the ration as a mixture.

R. E. PATTERSON: During the period 1934-37, the Big Springs Experiment Station of Texas compared group feeding and individual feeding, when full-feeding animals and when feeding 80% of a full-fed ration. During some of the years the group-fed animals excelled in gain, and other years the individually-fed steers excelled. When the gains were adjusted for feed consumption, the differences disappeared, however. Thus, it appeared that the difference often resulting when comparing individual and group feeding of steers is not a problem of the psychology of the steer but a problem of the psychology of the feeder.

C. J. BROWN: Data taken at the Arkansas Station shows that the heaviest calves at weaning eat the most during the feeding trials, and consequently, gain the most and have the heaviest final weights.

VIRGINIA AGRICULTURAL EXPERIMENT STATION

REGRESSION OF FEED CONSUMPTION ON WEIGHT AND CORRELATIONS BETWEEN DAILY GAIN AND EFFICIENCY[1] OF BULLS ON R.O.P. TESTS

C. M. Kincaid and J. E. Grizzle

		1951-52		1950-51		1949-50		1948-49		1947-48	
BULLS		df	M.S.	df	M.S.	df	M.S.	df	M.S.	df	M.S.
Groups		2	68.88**	2	35.35**	1	12.12	2	492.68	-	-----
Within Groups	Linear	1	871.71**	1	719.24**	1	64.16**	1	599.87**	1	2.20
	Residual	37	9.59	19	5.96	9	9.45	33	8.99	6	.32
Within Animal	Linear	1	1686.06	1	655.42**	1	2372.18**	1	1296.54**	1	412.22
	Residual	204	2.17	116	2.49	119	6.77	218	5.34	32	6.79
Regression (per lb.)	Within Group		.020		.024		.014		.015		.028
	Within Animal		.026		.022		.056		.033		.038
Correlation - Gain and											
	Observed Feed		.50		-.05						
	Adjusted Feed		.77		.84						
STEERS											
Groups		9	42.63*	8	6.81						
Within Groups	Linear	1	619.33**	1	164.56						
	Residual	25	19.74	20	10.87						
Within Animal	Linear	1	1365.72**	1	2386.00**						
	Residual	359	17.06	189	2.43						
Regression (per lb.)	Within Group		.024		.020						
	Within Animal		.015		.029						
Correlation - Gain and											
	Observed Feed		.46		.63						
	Adjusted Feed		.83		.88						

1. Efficiency ($\frac{\text{Daily Gain}}{\text{Feed per day}}$) was computed from (a) average daily gain and observed average daily feed consumption, and (b) average daily gain and average feed consumption adjusted for regression of feed on weight within groups.

* Significant ** Highly significant

J. E. FOSTER: Sixty-two Aberdeen-Angus and Hereford steer and heifer calves were fed individually through six 28-day periods from 202-370 days of age. Some calves were weaned at 90 days and others at 180 days of age. Average body weight and total TDN consumption per 28-day period were the variables studied. Statistically highly significant differences were found between sexes for both weight and TDN based on the 202-370 day period. Differences between breeds, years, or weaning age groups were not significant for either weight or TDN. Highly significant differences were found between feeding periods in both weight and TDN. Average weight and TDN consumption 28-day period to period increased in rectilinear manners. Most of the zero order correlation coefficients between average weight and TDN consumption fell within a range of 0.80 to 0.86. Rectilinear regression coefficients ($b_{yx,y}$ = T.D.N. and x = average weight) based on "error line" from covariance studies were in the range of 0.40 to 0.44.

L. E. JOHNSON: During the last few years I have frequently noted that the most efficient bull or steer in an individual feeding test, as judged by feed per 100 pounds gain, was not a very desirable individual. If there is much difference in the starting weights of calves, the light-weight animals invariably have a considerable advantage in efficiency. In the last annual report of NC-1, we published the individual feed records of South Dakota's test bulls. The most efficient bull as judged by feed per 100 pounds gain was No. 29. He made each 100 pounds gain on 533.5 pounds of mixed concentrates and roughage; but this bull weighed only 258 pounds at the start while the average bull weighed 429 pounds. He gained only 2.33 pounds daily while the average bull gained 2.46. No. 29 may have made his gains efficiently but in this case I am sure efficient gains are not synonymous with economical beef. I have collected some data at the U. S. Range Livestock Station and the University of Nebraska that may give you some help on our problem of measuring efficiency when individually feeding.

At the U. S. Range Livestock Station, Miles City, the workers have been using gain per 100 pounds TDN as the measure of efficiency. A preliminary analysis made from a portion of the Miles City data by Ray Woodward shows the following correlation coefficients:

Efficiency with

Birth wt. - - - - - - - - -	-.0350	Slaughter grade - - - - - -	-.0550
Weaning wt. - - - - - - - -	-.4469	Carcass grade - - - - - - -	-.0719
Age at weaning - - - - - -	-.2492	Area of eye muscle- - - -	-.0398
Final wt. - - - - - - - - -	-.0517	Depth of fat over eye - -	-.1460
Daily gain - - - - - - - -	.2246	Shipping shrink - - - - -	.0675
Sales wt. - - - - - - - - -	-.0695	Dressing % - - - - - - -	-.1942
Carcass wt. - - - - - - - -	-.0933	Length of body - - - - -	-.1595
		Length of leg - - - - - -	.2224

At the Nebraska station correlations between characteristics measured on 30 bulls are shown in Table 1. Column H is feed required to take each bull from 550 pounds to 650 pounds in weight. The efficiency values of I and J are those explained by Hankins and Titus in the 1939 USDA Yearbook of Agriculture, pages 465 to 467. Digestion trials were run on all bulls in the test.

TABLE 1. Correlation of various production characteristics with different efficiency measures - 30 bulls tested. All bulls weaned at 196 days, group fed for 28 days, and all individually fed for 166 days.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
											Digestibility Factors					
	Birth Wt.	Wean. Wt.	Daily Gain Birth to Wean.	Initial Wt.	Final Wt.	Daily Gain in Feed Lot	Feed 100# Gain	Feed 100# Gain 550#-650#	Eff. 550#	Eff. 700#	Prot.	Dry Matter	Fat	Fiber	NFE	TDN per 100# Gain Above Main.
A	1.00	.56	.44	.50	.69	.55	-.08	-.18	.43	.43	.04	-.13	-.18	.13	.29	
B			.99	.89	.28	.33	.34	-.21	.32	.44	.21	.02	-.09	.004	.07	
C				.87	.83	.27	.38	-.18	.28	.40	.24	.003	-.04	.02	-.04	
D					.85	.11	.60	-.10	.04	.30	.14	.02	-.08	.02	-.10	.49
E						.06	.17	-.31	.34	.59	.24	.09	-.16	.10	-.24	
F							-.60	-.47	.59	.67	.24	.18	.16	.16	-.27	-.33
G							.38	-.44	-.36	.09	.46	-.47	-.12	.05	.89	
H								-.44	-.41	-.14	.08	.02	.002	.07	.37	
I									.61	.17	.01	-.05	.20	-.16	-.39	
J										.04	-.18	-.21	.34	-.39	-.34	
K											.31	.16	-.07	.27		
L												.68	.42	.52		
M													.24	.30		
N														-.46		
O																
P																

H. A. STEWART: In the production of beef we must give consideration to carcass quality. Professor L. E. Kunkle and B. L. Warwick will discuss some detailed carcass studies that are possible in our breeding programs.

DETAILED CARCASS STUDIES IN A BEEF BREEDING PROGRAM

L. E. Kunkle

In determining the true value of beef cattle, we need to know what is under the hide. This involves detailed carcass studies. We think meats men can assist you in this part of your program.

The following forms are used in collecting data on experimental cattle at Ohio State University.

Ohio Agricultural Experiment Station
Experimental Beef Slaughter Record

_____Time, Date of slaughter
_____Identification
_____Sex
_____Breed
_____Live wt. at slaughter
_____Blood (lbs.)
_____Head (lbs.)
_____Fore leg & feet (lbs.)
_____Fore leg & feet (In.) (circum)
_____Hind leg & feet (lbs.)
_____Caul fat
_____Hide
_____Bladder (lbs.)
_____Empty bladder (lbs.)
_____Urine (lbs.)
_____Pluck
_____Paunch (lbs.)
_____Intestine (lbs.)
_____Empty paunch (lbs.)
_____Empty intestine (lbs.)
_____Total fill
_____Ruffle fat
_____Brain

Time taken off feed _____
Live (Wt. end of feed _____(lbs.)
(Wt. 24 hr. shrink _____(lbs.)
(Shrink (24 hr.) _____(lbs.)_____
Total time off feed_____
Total shrink_____lbs._____%
Price_____Cost_____
Liver_____lbs._____value
Heart_____lbs._____value
Tongue_____lbs._____value
Sweetbreads_____lbs.____value
Cheek meat_____lbs.____value
Tail_____lbs._____value
Carcass number
Hot carcass R._____L._____
Chilled carcass (24 hr.)
R._____L._____
Chilled carcass (48 hrs.)
R._____L._____
Cooler shrink_____lbs.
Dressing %_____hot
Hot dress-2½%_____
Actual Cold Dress %_____
Carcass cost_____

Carcass Number_____

Carcass Grade C_____ F_____ Q_____ Final USDA Grade_____

Color Reading_____ Fat_____

Ribeye Measurements_____ Lean_____ Fat_____

Left Side		Right Side				
	Whlse. Cut		Whlse. Cut	E.P.	Bone	Fat	Trim
Chuck		Chuck					
Rib		Rib					
Foreshank		Foreshank					
Brisket		Brisket					
Plate		Plate					
Round		Round					
Loin End		Loin End					
Short Loin		Short Loin					
Flank		Flank					
Kidney Knob		Kidney Knob					
Hanging Tender							
TOTAL		TOTAL					

Height of withers_____ Carcass Length_____ Heart Girth_____

Depth of Chest_____ Width through shoulders_____ Length of leg_____

Circumference of middle_____ Width through rounds_____

" rear flank_____ Circumference of round_____

" shin bone_____

" round (right to left Patella)_____

The following tables contain the completed slaughter data on individual animals in the age of castration study conducted by our Agricultural Experiment Station.

AGE OF CASTRATION PROJECT
Ohio Agricultural Experiment Station and Ohio State University

Lot 1 - Bulls

Cattle No.	Dress. % (1)	Head lbs.	Hide lbs.	Chilled Carcass	Carcass Grade	Edible Portion % (2)	Bone %	Fat %
3	59.35	30.1	81	553	H.Good	77.84	15.79	5.81
10	59.31	27.0	79	471	Av.Good	78.63	15.61	4.73
6	60.19	28.0	92	525	H.Good	76.95	16.75	5.29
8	60.20	30.0	82	593	H.Good	78.46	16.17	4.98
5	58.61	26.0	91	546	H.Good	76.15	16.98	6.15
9	61.06	31.2	96	638	Av.Good	77.90	15.49	6.11
4	59.54	29.3	90	538	L.Good	78.06	17.26	4.86
2	59.43	28.0	95	534	Av.Good	77.86	15.58	5.40
1	59.29	32.6	92	578	H.Good	76.01	16.71	6.92
7	61.23	29.9	84	583	Av.Good	79.15	15.82	4.14
Mean	59.82	29.30	88.2	555.9	Av.Good	77.70	16.22	5.44
Standard Deviation						1.0303	.65339	.8027
Standard Error						.32627	.2066	.2538

Cattle No.	Fat (Ether Extract) %	Cyano Met.Myoglobin Wet basis %	Hydroxy Proline Wet basis %	Tenderness 3 days	Tenderness 15 days
3	2.16	0.5503	0.0522	6.00	8.67
10	4.19	0.5120	0.0564	6.75	8.50
6	2.54	0.4180	0.0548	6.75	7.92
8	3.70	0.3990	0.0713	4.65	7.58
5	2.89	0.5645	0.0554	4.42	7.58
9	2.85	0.4295	0.0602	6.67	7.50
4	2.09	0.4530	0.0647	4.92	7.17
2	2.40	0.4265	0.0661	4.75	7.08
1	3.98	0.4440	0.0674	6.00	7.08
7	1.95	0.4980	0.0603	4.92	6.67
Mean	2.875	0.4695	0.0615	5.58	7.57
Standard Deviation	0.7714	.0713	.00632	.8986	.657
Standard Error	0.2438	.0226	.0020	.285	.208

(1) Dressing % calculated using weight at Wooster, shrunk 3% and hot carcass shrunk $2\frac{1}{2}\%$

(2) Edible Portion - Muscle and Fat, covering of 3/8" maximum thickness.

AGE OF CASTRATION PROJECT

Lot 2 - Early Castration

Cattle No.	Dress. % (1)	Head lbs.	Hide lbs.	Chilled Carcass	Carcass Grade	Edible Portion % (2)	Bone %	Fat %
22	61.71	26.5	63	522	L.Prime	74.15	14.74	10.5
20	60.05	25.3	60	458	H.Choice	76.11	16.29	7.4
25	61.89	27.2	69	540	H.Choice	72.48	14.46	11.9
19	61.22	26.7	64	530	H.Choice	72.74	15.07	12.0
24	59.87	27.5	71	550	H.Choice	73.78	17.54	8.5
18	61.10	26.8	69	533	L.Prime	72.59	14.21	12.1
23	58.78	27.0	72	496	L.Prime	72.06	16.98	10.3
16	61.58	26.6	72	524	Av.Choice	73.66	15.87	10.2
21	61.32	25.5	71	539	L.Prime	74.86	13.61	11.2
17	62.14	28.0	82	603	L.Prime	74.62	15.30	9.8
Mean	60.97	26.71	69.13	529.5	L.Prime	73.71	15.41	10.4
Standard Deviation - - - - - - - - - - - - - - - - - -						1.2711	1.2536	1.6
Standard Error -						.4019	.3964	.5

Cattle No.	Fat (Ether Extract) %	Cyano Met.Myo-globin Wet basis %	Hydroxy Proline Wet basis %	Tenderness 3 days	Tenderness 15 days	
22	5.72	0.5503	0.0418	7.42	9.25	(Test
20	3.71	0.4920	0.0553	7.42	8.66	(Panel
25	6.86	0.4004	0.0426	8.25	8.43	(Rat'g
19	8.96	0.4001	0.0490	6.17	8.08	(10 is
24	4.92	0.4801	0.0443	7.83	8.00	(very
18	6.24	0.3990	0.0532	7.75	8.00	(tender
23	6.92	0.4559	0.0521	5.67	7.83	(
16	5.86	0.4338	0.0523	6.92	7.75	(1 is
21	6.68	0.3598	0.0504	7.58	7.67	(very
17	4.93	0.3438	0.0519	7.83	7.42	(tough
Mean	6.080	0.4315	0.0493	7.284	8.108	
Standard Deviation	1.272	0.8120	0.00474	0.7789	0.4913	
Standard Error	0.4023	0.0257	0.00150	0.2530	0.1560	

(1) Dressing % calculated using weight at Wooster, minus 3% and hot carcass shrunk 2½%.
(2) Edible Portion - Muscle and Fat, covering of 3/8" maximum thickness.

AGE OF CASTRATION PROJECT

Lot 3 - Late Castration

Cattle No.	Dress. % (1)	Head lbs.	Hide lbs.	Chilled Carcass	Carcass Grade	Edible Portion % (2)	Bone %	Fat %
40	60.92	23.4	70	492	H.Choice	75.62	14.86	9.00
31	61.76	28.2	68	504	L.Prime	75.75	14.44	9.09
37	63.75	27.4	63	539	L.Prime	74.86	17.62	7.62
41	61.65	26.4	71	543	Av.Prime	74.19	14.35	11.53
35	61.69	27.1	73	487	H.Choice	74.71	15.45	9.23
33	60.60	25.0	73	613	H.Choice	73.56	14.79	11.40
38	62.83	28.8	84	566	H.Choice	71.60	17.01	10.63
36	60.06	23.4	70	486	L.Prime	73.47	15.98	10.67
34	61.49	29.0	77	568	Av.Choice	74.68	15.13	9.51
39	57.70	23.0	68	464	Av.Choice	72.18	16.19	10.99
Mean	61.24	26.2	71.7	526.2	H.Choice	74.08	15.58	9.97
Standard Deviation						1.368	.9926	1.2667
Standard Error						.4328	.3137	.4006

Cattle No.	Fat (Ether Extract) %	Cyano Met.Myoglobin Wet basis %	Hydroxy Proline Wet basis %	Tenderness 3 days (Test Panel Ratings 10 very tender, 1 very tough)	Tenderness 15 days (Test Panel Ratings 10 very tender, 1 very tough)
40	7.18	0.3699	0.0552	7.08	8.50
31	6.35	0.4150	0.0528	7.00	8.42
37	3.70	0.4191	0.0505	6.92	8.42
41	7.96	0.4950	0.0524	6.33	8.25
35	7.62	0.3145	0.0565	6.83	8.00
33	7.02	0.2940	0.0575	7.75	7.75
38	7.80	0.4220	0.0535	6.58	7.17
36	7.25	0.3685	0.0551	4.50	7.00
34	5.77	0.5010	0.0557	6.67	6.75
39	5.72	0.4880	0.0663	5.50	5.92
Mean	6.637	0.4087	0.0556	6.52	7.62
Standard Deviation	1.2990	0.07748	0.00424	0.5859	.8721
Standard Error	0.4106	0.02449	0.00134	0.186	0.276

(1) Dressing % calculated using weight at Wooster, minus 3% and hot carcass shrunk 2½%.
(2) Edible Portion - Muscle and fat, covering of 3/8" maximum thickness.

USE OF CARCASS DATA IN A BEEF CATTLE BREEDING PROGRAM (1)(3)

Bruce L. Warwick (2)
Texas Agricultural Experiment Station
Bluebonnet Farm
McGregor, Texas

(1) Cooperative with the U. S. Department of Agriculture and is a part of the S-10 Southern Regional Beef Cattle Breeding Project.

(2) This work was carried out by a group of workers; O. D. Butler, John Moffit, J. K. Riggs and others of the Animal Husbandry Dept., College Station, and M. W. Hazen, U. S. D. A.

(3) To be presented at the joint meeting of the Technical Committees of the Southern and the Midwestern Beef Cattle Regional Projects, Stillwater, Oklahoma, July 21, 1952.

In 1948 the Texas Station organized a new beef cattle breeding project located at Bluebonnet Farm, McGregor. This project was to include as the major selection criteria, gaining ability, heat tolderance and carcass value. Following the lead of pioneer work done at several other stations, particularly at Miles City, Montana, and Balmorhea, Texas we were able to set up satisfactory tests to measure gaining ability. Heat tolerance testing is still in the planning stage, but we have hopes of being able to have a heat chamber set up within the next six months. With both gaining ability and heat tolerance it is entirely possible to get a direct figure for the live animal which we can compare with that of the rest of the group being tested. In fact, the work with gaining ability had already been carried to the point where enough was known about the magnitude of the heritability figures that we felt safe in using the individual data directly for selection purposes, rather than as a progeny test only. Some one has coined the expression "It's like milking the bull".

Study of carcass value offers a different picture. Because it is obviously impossible to castrate all the bull calves, put them through a feed lot evaluation test, butcher them to get the individual figures on carcass values, and still have the animals for direct selection purposes, it becomes necessary to use samples of breed and sire groups. The data can be used as progeny tests and for comparison of breeds, strains and crosses. This problem is not new and the workers with swine have pretty well solved the difficulties with that species. The absence of litters in beef cattle limits the usefulness of the study of carcasses in relation to the breeding program.

A sample of the group may be adequate to differentiate sires or breeds or certain crosses. On the other hand when we have experimental animals which are as expensive as cattle, it is always necessary to limit the numbers. By taking a sample of the progeny group for carcass work it automatically reduces the number left for selection. And who is bold enough to be sure that he has not castrated the wrong bull of the group? One other alternative is to set up special tester groups. On paper this is fine, but

practically it runs into many pitfalls. A compromise combination of these two seems to be the best answer at present. On superficial consideration it might be considered enough to substitute the conformation and condition score for the carcass data. We have data which point strongly to the fallacy of this approach.

After we have our group or sample of steers and test them in the feedlot, we need more detailed data by individuals than supplied by dressing percents and carcass grades. The actual retail selling value of a carcass in these times is based on the OPS values set on the wholesale cuts. With this in mind we set up a work sheet listing each wholesale cut with the OPS price according to the official grade of the carcass. With those of our steers which were slaughtered in the Meats Laboratory, these cuts were made according to the technique described by Hankins and weighed separately. The left half was used. Then it became a matter of arithmetic to come out with a total value for the carcass, average value per pound for carcass and average value per pound of live weight based on the carcass values. In addition to these cut out values, we were interested in the per cent of edible meat. An estimate of this was made, together with the per cent of separable fat from the 9, 10, 11 rib cut. In addition to this we felt that we needed the data for the whole carcass, and by wholesale cuts. In order to do this each cut from the left half was boned out and weighed separately. With our data the correlation between these two sets of figures is .77 with the regression coefficient of .485% and the coefficient of determination of .59%. The per cent of edible meat estimated from the 9, 10, 11 rib analysis was about 1.25 points lower than obtained when the whole side was boned. We need to use the more precise figures. A few other carcass measurements were made but most emphasis was placed on the values which could be related directly to selling value of the carcass.

The first steers studied in detail were born in the spring of 1950 and slaughtered in May 1951 immediately following the 1950-51 evaluation test. Of the 73 steers on test we slaughtered 11 Hereford and 26 F1 Hereford x Brahman steers at the Meats Laboratory, College Station, for detailed records. These represented 3 Hereford and 5 Brahman sires. We found some surprises, but our sire groups were necessarily very small in some cases. Also, we were able to get a better picture of the comparative values of the Herefords and crossbreds. The average dressing per cent of the crossbreds was higher by 2.58 points than the Herefords. This was enough so that when the values of the live animals were computed from the cutout values, the crossbreds had a slightly higher average value, in spite of slightly lower average carcass grade. The per cent edible meat, figured from the boned half carcass, was essentially the same in the two groups, 85%. The length of leg as measured on the carcass was 4 cm. longer for the crossbreds, and yet the detailed figures do not indicate wastiness of the carcasses. The area of the rib eye muscle was approximately one square inch larger in the crossbred carcasses.

In comparing sires we had a Hereford bull which had the poorest conformation of the three represented, and progeny which on foot graded the lowest of the Herefords, and graded nearly at the bottom of the 8 sire groups including crossbreds, yet the carcasses of his progeny averaged among the highest in carcass grade of the steers slaughtered. His progeny

had the highest live weight value per pound of the three Hereford groups. On the other hand the Hereford bull which was liked best both individually and by the slaughter grade of his steers on foot had progeny whose average live weight value was at the extreme bottom, including crossbreds.

Our evaluation testing of bulls and heifers is on bulky growing rations. It would simplify our management and would also be cheaper if we could feed our steers on the same ration. This year we included one pen each of Herefords and F_1 Hereford x Brahman steers on the growing ration. Twenty-five steers from the growing ration group and 25 from the high concentrate groups were put through the Meats Laboratory and detailed records secured on the carcasses. Unfortunately, due to press of budget matters we have not yet been able to get the necessary IBM and statistical assistance to complete the analysis of the data. We also included on the growing ration, 21 crossbred bulls raised on our project; 7 of which were slaughtered for detailed carcass study at College Station.

The cutting and getting the large number of detailed weights called for very careful organization on the part of our Meats Laboratory staff. The 37 carcasses processed last year seemed like about the maximum they could handle satisfactorily within the allowable time. Mr. Butler who was the wheel horse last year is now on leave, but Mr. Moffit who worked with him last year was able to profit by the difficulties encountered last year, and handled 57 carcasses very satisfactorily this year. I say satisfactorily with reservations. That is from the standpoint of getting the data in good shape. On the other hand we came up against a marketing problem for the boned meat from 57 sides. It seems strange indeed that the meat trade should be so reluctant to handle boned meat from carcasses; most of which graded choice and were of a very desirable weight. Buyers were eager to get the sides which had not been cut and boned. In the procedure, the boned cuts from each wholesale cut were kept separate so that the identity was not lost. Some of us purchased a side of this boned meat for our own locker, and wonder how any one could resist such meat.

Eating is not only a necessity and a habit, but is hedged about by custom and prejudice. This is found in many places with many kinds of food. Not many of us would relish the thoughts of eating fly maggots collected from certain plant blossoms, yet we know that such delicacies are in high repute in certain tropical countries. In our own experience, we encountered a colored family who enjoyed several goat carcasses which had been sacrificed in the laboratory, only to refuse any more when the man learned that these goats were killed in the early stages of pregnancy! Any food presented in a new or unfamiliar form is likely to be discriminated against at first. Since time out of mind, the Anglo-Saxon peoples have been handling the meat carcasses in certain more or less standard ways. The local meat market has a meat cutter who likes the looks of certain shaped carcasses. It is natural, because he grew up that way. This is even carried over into the grading of carcasses. By no stretch of the imagination can the slight differences in uniformity of width be reflected in the amount or the taste of the meat. Yet this one point may change the grade of the meat. We have all been led to think that longer legs cause much more waste, associated with lower dressing percentages. We have quoted figures from our limited data which indicate that this is

not necessarily true. While of necessity we have to evaluate the carcasses in terms of the present market standard, we should also evaluate our products in terms of net quantity of food and look for better measures of quality. We are in a changing world. Our markets and methods of marketing are changing. Some of our marketing specialists are setting up tests in chain stores to determine the actual consumer preference. Even without this, we know that the demand for beef in the higher grades is rather limited. We should be ready to evaluate our meats in terms of the quantity of red meat produced. How many of you have had complaints from your wives as to the amount of bone in the beef they buy? Even when we had a whole carcass of beef, which we raised on our own land, put in our locker, the same complaint was heard. Of course, we as Geneticists make no pretense of breeding beef with all round steak. Yet no one wants to buy bone, except as a trademark for the particular cut. We may see this demand for identifying bones disappear. The pre-packaged trade in frozen products is fast making inroads on the trade of the aproned meat cutter with the heavy hand.

We as Geneticists and Animal Husbandmen should be in the lead in connection with this rather than followers. Yet, it is extremely difficult to finance the type of work mentioned above. It cost us about $13.00 per head in extra labor and lowered price for meat to get the data on 37 head last year, which totals $481.00. This year the cost was $18.83 per head on 57 head, which comes to $1073.31. However, the loss or cost entailed on the 50 head of steers averaged $28.09 per steer or a total of $1404.50. The reason for the lower figure for the 57 head is based on the more favorable sale of the meat from the bulls over selling them alive at Fort Worth.

The carcasses from the 7 bulls graded with the steers and sold as readily and at the same price. The bulls which were sold at Fort Worth at the same time as the steers brought $8.56 per cwt. less than the steers, but graded with them on the rack. The 7 processed at the Meats Laboratory netted $47.33 per head more than if they had been sold at Fort Worth. It may be of interest to this group to know the relative costs of testing our crossbred bulls and crossbred steers on the same growing ration. The 21 crossbred bulls gained an average of 99 pounds more during the 154-day period and ate enough more feed to cost $10.59 per head more. Sold as bulls at Fort Worth at $25.00 per cwt. they brought $41.29 per head less than they would have sold for if they had been castrated, gained proportionately less and sold at our average Fort Worth price for steers, $33.56 per cwt. This means that the evaluation test alone on these cost us $51.88 per head. However, if we had put them all through the Meats Laboratory this cost difference would have been changed to $16.77 per head increase in value over what they would have netted if they had been steers. This might be part of the answer to defraying the costs on securing the detailed carcass data.

H. A. STEWART: Dr. L. N. Hazel will discuss construction and use of selection indexes in beef cattle breeding.

CONSTRUCTION AND USE OF SELECTION INDEXES FOR BEEF CATTLE

L. N. Hazel, Iowa State College

The indexes given here are not intended for use in selecting beef cattle. They are constructed from statistics which have been assumed somewhat arbitrarily, whereas accurate estimates would be wanted for useful

indexes. The purpose is to show how indexes may be constructed once the accurate estimates are available.

The goal toward which selection will be directed must be established as a first step in index construction. Economic consideration should be of paramount importance in establishing goals. More nearly esthetic factors are likely to have economic values near zero, but they may merit some attention in the final index because they may be genetically correlated with economic characters.

Each animal has a genotype for each character being considered in the selection program. Its over-all or aggregate genotype is the sum of the individual genotypes, each weighted by the economic value of each trait. Thus,

$$H = a_1G_1 + a_2G_2 + \ldots + a_nG_n \qquad (1)$$

Here the a's represent the increase in net income expected to accrue to the beef enterprise if that corresponding trait is changed by one unit. Later examples will clarify this more. The G's represent the sum of the average effects of all genes the animal has which influenced the respective characters.

Economic Values

The economic values for a few of the important characters in a beef cattle enterprise are given in Table 1, along with the other statistics needed. As research laboratories interested in all phases of the beef industry, it seems best to set these up on an industry-wide basis, thus avoiding the special-interest problems which arise between ranchers, as compared with cattle feeders, etc.

The units in which a character is measured and the range over which the animals vary are very important in understanding the particular economic values assigned. These factors do not influence which animals will be selected by different indexes, provided the values assigned are correct. For example, one laboratory might score calves over a range of 40 units, while another scored over a range of 5 units. The first laboratory would have an economic value for score only 1/8 as large as the second; whereas the standard deviation would be 8 times as large for the first.

Weaning weight in Table 1 was assigned an economic value of .30. Weaning weight is measured in pounds and each pound is worth 30 cents or 3/10 of a dollar. If this extra weight is obtained at extra feed costs, as when calves are creep fed, the extra cost per pound should be subtracted from the .30.

Weaning score. Calves are scored into about 5 classes (it was assumed) giving a standard deviation of one unit. The average difference in sale price for adjacent classes is 50 cents per hundred. Since the average weaning weight is 400 pounds, an increase of one score means an increase of $2 in income, no increased costs being associated with the scores.

Feed efficiency is figured as the total feed eaten divided by the total gain made in the feed lot. For most laboratories, feed efficiency will average about 7 and vary from a little below 6 to slightly over 8. An animal with an efficiency of 7 will eat about 500 pounds less feed than an animal with an efficiency of 8 (3500 pounds of feed, as compared with 4000). Feed at .03 per pound means an economic value of -15 for efficiency. It would be proper here to add the extra labor cost of handling the extra 500 pounds of feed, but this probably would be compensated by the extra fertilizer value of the manure.

Slaughter grade has an economic value of 10 because steers weighing 1000 pounds sell for $10 more per head for each increase of one slaughter grade. It was assumed that the scores varied over a range of about 5 units; i.e., a steer of low grade might bring $30 per cwt. while a steer of high grade would bring $35 per cwt. This accounts for the standard deviation of one unit.

Rate of gain is worth very little for itself alone. A steer that gains 3 pounds a day would be in the feed lot about 167 days, while one that gains 2 pounds per day would be in the feed lot 250 days. This difference of 83 days, figured at 20 cents per day for labor, investment, etc., is $16 for one pound in rate of gain.

Definition of the Index

The index is a linear function of the observed records,

$$I = b_1X_1 + b_2X_2 + \ldots + b_nX_n \qquad (2),$$

where the b's are values chosen so the I for each animal will correspond as closely as possible to its true H value. The X's in equation 2 represent records on the animal in question or on its relatives. Each X in the index need not have a corresponding G in the aggregate genotypes of equation 1, or vice versa. Perhaps a better way to say it is that some of the a values of equation 1 may be zero if a trait has no economic value for itself alone. Likewise, some of the b values of equation 2 may be zero, if that trait cannot be measured directly or if it contributes nothing to the discrimination between animals. Obviously some traits may be useful only as indicators of other traits under this scheme.

The b values of equation 2 are partial regression coefficients, chosen so as to make the correlation between H and I as large as possible. This corresponds to the least squares procedure of minimizing the sum of squares of the deviations between H and I, $(H - I)^2$.

The least squares equations which must be solved simultaneously are:

$$b_1V(X_1) + b_2\text{Cov } X_1X_2 + \ldots + b_n\text{Cov } X_1X_n = \text{Cov } X_1H$$

$$b_1\text{Cov } X_1X_2 + b_2V(X_2) + \ldots + b_2\text{Cov } X_2X_n = \text{Cov } X_2H$$

$$b_1\text{Cov } X_1X_n + b_2\text{Cov } X_2X_n + \ldots + b_nV(X_n) = \text{Cov } X_nH$$

Table 1. Statistical information required (arbitrary values)

Character	Economic Value	Standard deviation	Herita-bility	Phenotypic correlation			Genetic correlations			
			2	3	4	5	2	3	4	5
Weaning weight (1)	0.3	40.0	.25	.4	.1	0	.2	.2	.2	-.1	.3
Weaning score (2)	2.0	1.0	.35		0	.2	0		0	.6	-.2
Feed efficiency (3)	-15.0	0.5	.50			0	-.3			.3	-.5
Slaughter grade (4)	10.0	1.0	.40				-.2				-.3
Rate of gain (5)	16.0	0.3	.65								

Table 2. Values for the simultaneous euqations

Character	Phenotypic variance	Phenotypic covariances				Cov X;H
		2	3	4	5	
1	1600	16	2	0	2.4	114.08836
2	1		0	.2	0	3.19715
3	.25			0	-.045	-1.46392
4	1				-.06	2.32951
5	.09					1.49645

The statistical information needed is represented by the variances of the characters V (X), the covariance between characters, Cov XX, and the covariances between the characters and the aggregate genotype, Cov XH. These were constructed from Table 1, where the information is given in biologically interpretable form as standard deviations, heritabilities, phenotypic and genetic correlations.

Examples of Index Construction

Table 2 gives the information needed to solve the simultaneous equations. The values in Table 2 were constructed from Table 1. V(X) was obtained by squaring the standard deviations, while Cov XX was computed as the product of the correlation and the two standard deviations

for each pair of characters. The covariance between each character and the aggregate genotype was computed as follows:

$$\text{Cov } X_1H = a_1g_1^2\sigma_{X_1}^2 + a_2g_1g_2r_{G_1G_2}\sigma_{X_1}\sigma_{X_2} + \ldots + a_5g_1g_5r_{G_1G_5}\sigma_{X_1}\sigma_{X_5}$$

$$= g_1\sigma_{X_1}\left[a_1g_1\sigma_{X_1} + a_2g_2r_{G_1G_2}\sigma_{X_2} + \ldots + a_5g_5r_{G_1G_5}\sigma_{X_5}\right]$$

$$= (.5)(40)\left[(.3)(.5)(40) + (2)(.5916)(.2)(1) + (-15)(.707) + (.2)(5) + (10)(.6325)(-.1)(1) + (16)(.8062)(.3)(.3)\right]$$

$$= .5(40)(5.704418) = 114.08836.$$

This must be done as above for as many of the characters as are to be used in the index.

A convenient index would be based on the two weaning traits, weaning weight and weaning score. The simultaneous equations are (from Table 2):

$$b_1\ (1600) + b_2\ (16) = 114.08836$$

$$b_1\ (16) + b_2\ (1) = 3.19715$$

These give the solution:

$$I_1 = .04682\ X_1 + 2.44803\ X_2\ .$$

The regression coefficients for this index and for two more complete indexes are given in Table 3. I_2 does not require individual feeding, since feed efficiency is not required for the index.

Remember that all of the indexes have the same goal (improvement as defined by the same H) but simply differ in the amount of information or records needed on each animal. Since genetic improvement will be proportional to the multiple correlation between the index and H, (R_{IH}), this correlation provides a means of comparing the accuracy of the indexes. The multiple correlations given in Table 3 show that genetic improvement in H will be almost doubled by including slaughter grade and rate of gain, as well as weaning weight and weaning score. However, the further inclusion of feed efficiency increases the rate improvement only slightly. If the economic values, heritabilities, etc., assumed here are at all representative of those which actually exist, it is doubtful if this slight extra improvement will be worth the extra labor required in individually feeding bulls. That is, the extra effort might well be more profitably expended in another direction. The primary reason feed efficiency adds little to the improvement is that a genetic correlation of -.5 was assumed here between feed efficiency and rate of gain. This is not

intended to be an answer to the problem of advisability of feeding bulls. The problem can only be answered after further research has made the necessary information available. The only purpose here is to show how index approach can be used to answer such problems.

The last three columns of Table 3 show the genetic improvement in each trait expected from a selection differential of one standard deviation for each index. This amounts to rigid selection of the best 38% of the indexes. Using I_1 causes greatest improvement in weaning weight, weaning score and slaughter grade, but causes no change in rate of gain, and feed efficiency will actually become poorer. Both I_2 and I_3 make less improvement in weaning weight and weaning score than I_1, as might be expected. However, they more than compensate for this by making considerable improvement in slaughter grade and rate of gain.

For characters as highly heritable as these have been assumed to be I_2 and I_3 are 81 and 85 per cent as effective in making genetic improvement as if the genotypes of the animals were known exactly. Thus, the accuracy of the information is not likely to be the limiting factor in improvement of beef cattle by breeding, if a good index is actually followed in practicing selection.

Table 3. Comparison of Indexes

Character	I_1	I_2	I_3	Genetic change per standard deviation in index		
				I_1	I_2	I_3
Weaning weight	.0468	.0217	.0295	6.76	5.52	4.76
Weaning score	2.4480	2.2583	2.1514	.27	.15	.15
Feed efficiency			-3.1825	.02	-.08	-.13
Slaughter grade		2.9592	2.8689	.14	.13	.09
Rate of gain		18.0216	16.1619	.00	.13	.14
R_{IH} and gain in H	.447	.812	.833	3.67	6.54	6.82

H. A. STEWART: Dr.G. E. Dickerson will discuss the subject, "Measuring the Amount of Selection Practiced".

MEASURING THE AMOUNT OF SELECTION PRACTICED

G. E. Dickerson, University of Missouri

Why Bother?

A. To determine how well actual emphasis on different characters in selection agrees with announced intentions (e.g., in the project plan!)and with theoretically expected maximum selection.

B. To see whether intended selection is modified to any important degree by natural or automatic selection or by character relationships.

C. To obtain approximate maximum estimates of improvement to be expected, for comparison with actual progress.

How Simple are the Calculations?

A. General method of calculating selection per unit of time from birth of progeny in a given year back to mean birth date of parents is:

$$\Delta P = \frac{N_1^s S_1 + N_2^s (S_1+S_2) + \cdots + N_1^d D_1 + N_2^d D_2 + \cdots}{N_1^s A_1^s + N_2^s A_2^s + \cdots + N_1^d A_1^d + N_2^d A_2^d + \cdots} \quad \Delta S + \Delta D = \bar{A}^s + \bar{A}^d$$

Where:

N_1^s, N_2^s, N_1^d, and N_2^d are weightings for sires and dams of the several age groups:

A_1^s, A_2^s, A_1^d, and A_2^d are mean ages of sires and dams of the several age groups when progeny are born:

S_1, S_2, D_1, and D_2 are selection differentials for first and second cullings among sires and dams.

B. To learn how intended selection is modified by natural selection or character relationships, can simply change the method of weighting (N) from: (1) Weighting each female placed on breeding list equally and each male by number of females assigned to him.

to: (2) Weighting each male and each female by number of calves produced.

to: (3) Weighting each sire and each dam used in a given year according to the number of replacement heifers plus the number of matings assigned to young bulls saved from that year's calves of each parent.

C. Characters to be studied might include:

1. Cow productivity – based on weaning weight of calves and using deviation from the age-year mean. In averaging several calvings from same cow, use repeatability of .5 and multiply by $\frac{n(G+E)}{nG+E} - \frac{2n}{n+1}$ to make deviations based on mean of several records comparable to those based on single records. In computing S_1, S_2, and D_1, would divide by 2, since performance is based on the dam's rather than on own performance.

2. Rate of growth – based on weight for age (13 months?) or rate of gain from 8 to 13 months of age.

3. Feed required per cwt. gain between 500 and 900 pounds live weight.

4. Score for live conformation at market weight.

5. Carcass worth per unit of live weight.

D. Examples of selection differential computation. Assume calves from 30 cows in 1952, 7 by sire A, 11 by sire B, and 12 by sire C. A and B are 2 years old and C is 3 years old, so that:

$$N_1^s = \frac{18}{30} = .6, \quad N_2^s = \frac{12}{30} = .4, \quad A_1^s = 2, \quad A_2^s = 3.$$

Of the cows, 10 are 2 years old, 8 are 3 years old, 4 are 4 years old, 4 are 5 years old, and 4 are 6 years old, making

$$N_1^d \text{ up to } N_5^d = \frac{10}{30}, \frac{8}{30}, \frac{4}{30}, \frac{4}{30}, \frac{4}{30}; \text{ and } A_1^d \text{ to } A_5^d = 2, 3, 4, 5, \& 6$$

years respectively. Thus for parents of the calves dropped in a given year (e.g., 1952), annual selection differential is:

$$\Delta P = \frac{.6S_1 + .4(S_1+S_2) + .33D_1 + .27(D_1+D_2) + .13(D_1+D_2+D_3) + .13(D_1+\ldots+D_4) + .13(D_1+\ldots+D_5)}{.6(2) + .4(3) + .33(2) + .27(3) + .13(4+5+6)} = 2.40 + 3.467 = 5.87 \text{ years}$$

1. For cow productivity (P) measured by weaning weights (W) adjusted to 182 days of age,

S_1 = 1/2 mean superiority in dams performance (P) for sires A and B, weighting each by his number of calves = $1/2\left(\frac{7(60)+11(80)}{18}\right) = \frac{68}{2} =$ 34 lbs. where 60 = P of dam of sire A = $\frac{2n}{1+n}\left(\bar{W} - \frac{\sum n(W-\bar{W})}{n}\right)$, etc.

$S_1 + S_2$ for sire C = 1/2 (80) = 40 lbs.

D_1= 1/2 mean superiority in dam's performance of 10 cows born in 1950 $= \frac{\Sigma 10^P}{2(10)} = 10$ lbs.

$(D_1 + D_2)$ = 1/2 mean superiority in dams performance of 8 cows born in 1949 $= \frac{\Sigma 8P}{2(8)} = 12$ lbs.

$(D_1+D_2+D_3)$= mean superiority in own performance in 2 calvings (n= 2) of 4 cows born in 1948 $= \frac{\Sigma 4^P}{4} = 22$ lbs.

$(D_1+..+D_4)$ = same for 3 calvings of 4 cows born in 1947 $= \frac{\Sigma 4^P}{4} = 20$ lbs.

$(D_1+..+D_5)$ = same for 4 calvings of 4 cows born in 1946 $= \frac{\Sigma 4^P}{4} = 16$ lbs.

Hence:

$$\triangle P = \frac{.6(34)+.4(40)+\frac{10}{30}(10+\frac{8}{30}(12)+\frac{4}{30}(22+20+16)}{5.867 = 2(2.933) \text{ years}} = \frac{50.93}{5.867} = 8.68 \text{ lbs.}$$

$\triangle S = \frac{36.40}{2.933} = 12.41$ lbs. for sires alone; $\triangle D = \frac{14.53}{2.933} = 4.95$ lbs. for dams alone.

2. For rate of growth (R), measured by 13 month weight in both bulls and heifers, adjusted for sex and method of feeding.

S_1= superiority in own weight for sires A and B, weighted by number of calves by each $= \frac{7(882)+11(810)}{18} - 800 = 38$ where 800 was $\bar{R}$ for 1950.

(S_1+S_2) = same for sire C in 1949 = 850 - 790 = 60 lbs. where 790 was $\bar{R}$ for 1949.

D_1= same for 10 cows born in 1950 $= \frac{\Sigma 10^R}{10} - 800 = 20$ lbs.

D_1+D_2 = same for 8 cows born in 1949 $= \frac{\Sigma 8^R}{8} - 790 = 30$ lbs.

$(D_1+..+D_3)$ = same for 4 cows born in 1948 $= \frac{\Sigma 4^R}{4} - 780 = 20$ lbs.

$(D_1+..+D_4)$ = same for 4 cows born in 1947 $= \frac{\Sigma 4^R}{4} - 750 = 10$ lbs.

$(D_1+..+D_5)$ = same for 4 cows born in 1946 $= \frac{\Sigma 4^R}{4} - 810 = 5$ lbs.

Hence:

$$\Delta P = \frac{.6(38) + .4(60) + \frac{10}{30}(20) + \frac{8}{30}(30) + \frac{4}{30}(20) - 10 + 5)}{5.867} = \frac{63.47}{5.867} = 10.82 \text{ lbs};$$

$\Delta S = \frac{46.8}{2.9335} = 15.95$ lbs. for sires alone; $\Delta D = \frac{16.67}{2.9335} = 5.68$ lbs. for dams alone.

3. The next step is to average the selection differentials (ΔP) over as many years as the data permit for each strain, and to multiply the mean selection differential ($\Delta \bar{P}$) by the estimated heritability (H) for each trait to obtain expected annual improvement from selection (ΔG). This may be compared with actual time trend or regression of performance on year (b_{YT}). If inbreeding has increased steadily either the expected improvement (ΔG) or the actual time trend (b_{YT}) will need to be adjusted for the estimated inbreeding decline. The ratio of actual time trend adjusted for inbreeding effects to the expected annual improvement ($\underline{adj.b_{YT}}$) is an estimate of the extent to which the genetic variability $\underline{G}$ in a character is due solely to average gene effects and is independent or positively correlated with other characters emphasized in selection. Of course, many years and many lines would be required for reliable estimates.

H. A. STEWART: Dr. P. W. Gregory will present new evidence on the use of the profilometer in identifying animals carrying the dwarf gene.

HETEROZYGOUS EXPRESSION OF THE DWARF GENE

P. W. Gregory

Hereditary dwarfism is of common occurrence in the Hereford, Angus, and Shorthorn breeds. The morphological manifestations indicate that there are several different genetic forms. The studies were made on the dwarf type discussed by Johnson et al., (1950), Carroll et al., (1951), and Gregory et al., (1951, 1952). All dwarfs were found to manifest a bulging forehead caused in part by a modification of the frontal bones. The bulging forehead is one of the characteristics of cretinism. Head form was studied from a reproduction of the median head profile on millimeter paper by means of a profilometer, Gregory and Brown (in press).

The studies revealed that in males 30 months of age or older the different genotypes for dwarfism are associated with profound differences in the median head profile. All that are homozygous for the dwarf gene possess bulging frontal bones in the region of the mid-forehead about half way between the nasal-frontal juncture and the parietal-frontal juncture; while at the same time, the region of the parietal-frontal juncture is substantially depressed. Heterozygous bulls are intermediate in head profile between dwarf and homozygous normal genotypes.

The data indicate thatt in males 30 months of age and older heterozygous and homozygous normal genotypes can be separated with approximately 95 per cent accuracy from the relations of three diagnostic points on the median

profile, namely the nasal-frontal juncture (NFJ), the mid-forehead point (MFP) and the parietal-frontal juncture (PFJ). All of these points can be located mechanically on the profile.

Further tests on the identification of genotypes from head profiles were made in collaboration with Drs. C. B. Roubicek, N. W. Hilston and W. W. Galgan. These collaborators obtained head profiles and measurements from mature bulls in Colorado, Wyoming and Washington and sent them to the California Station for classification. The identity of each animal and the results of progeny tests were withheld until the prediction of the genotype was made from the profile and head measurements. The predictions on all the 24 animals that were progeny tested were 20 heterozygous and four homozygous normal. These predictions are in complete agreement with the results of the progeny tests. These tests clearly indicate that it is possible for one to identify with a high degree of accuracy the genotype of mature bulls from head profiles and head measurements alone.

Since most herd sires and bulls for commercial beef production are selected before 30 months of age, it is necessary to recognize heterozygotes at an earlier age if breeders and producers are to be materially helped in the selection of sires free from the dwarf gene. Studies of profiles of bulls from 12 to 16 months of age indicate that the dwarf gene in the heterozygous state has some expression upon the head profile at this age range. Research is in progress to determine the possibilities of differentiating between heterozygous normal and homozygous normal animals at this age range.

July 22 - 1952
Tour of Breeding Projects in Beef Cattle and Swine at
Stillwater and Ft. Reno - Doyle Chambers, Chairman

8:00 AM Inspection Tour. The tour included:

1. Swine breeding farm, Stillwater. An inspection of inbred lines and line crosses was made.

2. Range west of Stillwater. The college beef breeding herds were inspected.

3. Swine breeding unit, Ft. Reno. An inspection of line-crosses was made.

4. Cattle breeding unit at Ft. Reno. An inspection of small-type Herefords, large-type Herefords, Larry Domino Hereford line, and Quality Prince Angus line was made. Facilities for weighing, sorting, branding and bleeding cattle were studied.

5. Cattle nutrition unit, Ft. Reno. Grade Hereford cows in the level of wintering and age of first calving experiment were inspected; also visited were the 2-year-old steers in wintering experiment involving protein and mineral supplements.

8:00 PM Beef Cattle Production in Hawaii

Dr. R. T. Clark discussed beef cattle production in Hawaii. His lecture was supplemented by a selected group of interesting and beautiful color pictures. The pictures included the cattle in the six privately-owned herds now being used in beef breeding investigations in Hawaii.

July 23, - 1952

Cooperative Animal Breeding Research, M. L. Baker, Chairman

M. L. BAKER: This morning the program will be divided into two sections - a section dealing with the philosophy of cooperative research, and a section devoted to the business of our two regional beef breeding projects.

The first man on our program is Dr. L. E. Hawkins, Director of the Oklahoma research program. Dr. Hawkins was trained in the field of animal breeding. He will discuss Cooperative Animal Breeding Research.

COOPERATIVE ANIMAL BREEDING RESEARCH

L. E. Hawkins

I want to talk with you from the position of an administrator who is attempting to direct cooperative research and account for federal grant and state funds. My comments shall deal chiefly with the mechanics of the operation and what I consider as fundamental guides in a cooperative program.

The Research and Marketing Act did not bring forth a new idea. It did not create cooperative research. It did greatly develop and advance cooperative research between the state and federal agencies, and private organizations, and should be given credit for this accomplishment. However, the amount of RMA money available to carry on your beef breeding projects is very small. Actually 9b3 funds are only token funds which have inspired the joining of hands between state and federal workers. All of our breeding projects are state projects and many of them are old line BAI projects; thus we find this work supported in a token way by 9b3 funds, and in a real way by BAI funds, state funds and state administered funds. When all of these funds are combined, we find we are able to do a job of research which farmers and stockmen are unable to do for themselves, and which we as states were unable to do alone effectively in the past.

Considering the brief time of these projects, you men deserve a hearty commendation on your accomplishments. You should be encouraged at the progress you have made in developing a working pattern and getting your work initiated. Fortunately, the proposition of working across state lines had been pioneered by other people before us. Dr. W. A. Craft's experience in the Swine Breeding Laboratory has undoubtedly speeded your work in beef cattle breeding.

It seems to me there are some dangers in big cooperative research. I believe, however, these dangers will never develop if the research worker remembers that his job is one of service to the people of the several states and of the nation. I want to stress to you who are

directly engaged in agricultural research that our moneys are public moneys that originate in the pocket of the taxpayer. Whatever pride an individual research worker may take in his work or the publication of his findings, such must be second to serving the public. I cannot over-emphasize this point.

Since the public must come first, nothing must get in the way of current and frequent up-to-date releases of our findings. Certainly the mechanics of cooperation must never be allowed to get in the way of getting facts out to our people.

If we as research workers have been vulnerable on any one point, it is that we are too slow in getting our findings out for use. Cooperative research must not further retard our releases. Whether you are developing a strain of livestock or developing a method of operation, never let anything get in the way of getting information out to individuals or persons who can use it. At the risk of seeming to be unreasonable on the subject of publication, I am going to say that timidity to publish because of state-federal cooperation must not be allowed to develop. Today everyone recognizes that our first preliminary findings are not always the whole truth, but I am talking of those points that appear worth releasing to farmers and stockmen, even though the whole truth is not known. Let us not allow anything to delay releasing such material. This can be done and still preserve your cooperative relationship and individual integrity. First, you must realize that your work is public property. The public would be entitled, if there were an occasion for it, to go into our files. We serve the public.

If I have a suggestion which I believe is more important than any other for making cooperative research effective, it is that the total of our responsibility is to the public, and not to state or federal government officials. We need to keep the public informed by reporting currently and on time. I have no suggestions for your pattern of cooperation. Your present one appears to be working well, and you are to be congratulated on the manner in which you are making progress.

M. L. BAKER: Thank you, Dr. Hawkins. I believe we can sum up what Dr. Hawkins has said by saying that even if we are in air-conditioned, well-constructed brick buildings, our work is still done out in the bright sunlight of public inspection.

A day or two ago someone said we should never ask important questions unless we had the answers. The gentleman who is to appear next on our program often asks very embarrassing questions. I am sure he has the answers, but just wants to find out if we do. Dr. Byerly.

COOPERATIVE ANIMAL BREEDING RESEARCH

T. C. Byerly

There is no more highly personalized vocation than that of the research worker. Research is done by individuals who can see problems as they exist, who can make assumptions, who can apply or develop techniques for finding answers to the problems, all without the help of others. Cooperative research as we want it means these same men will work together for the good of all and yet not destroy the individual and personalized efforts of each.

Thus, it becomes a matter of a lot of rules of exchange. This conference is a good example of such exchange of ideas.

The pattern of cooperative research is like a gold rush. Someone makes a strike and we all rush to that point. They come by different ways. Some die on the way. Some only serve those who pan for the gold. Often the man who makes the original strike loses his gold. This is all true in research. It will still be true in cooperative research. As a student I thought that scientists had only the highest of ethics. In the past 25 years I have found their ethics above average but not perfect. I presume we represent an average group of scientists in our ethics. If we are sold on our research, however, I am sure we can work together cooperatively for the benefit of our project.

A year ago it became possible to tell those of you concerned with research in beef cattle breeding that it was our intention to support beef cattle breeding on a sizable basis. We feel that it is best to operate our work in cooperation with that of the states. We now have six federal stations at which beef cattle breeding is being done cooperatively with the states. In two of these beef cattle breeding is really the only work that is under way. In the others a more varied program is being operated. At Fort Reno, as you saw yesterday, the beef breeding work is a minor part of the total program.

As for money, the approximate total amount going into beef cattle research is $312,000. More money is needed to do the job.

You know the value and the future of your work. I know its value. But it is often difficult to explain this to the administrators at the top who are trying to develop an over-all program. They continually want to know why there is need for so much land, so many cattle, and so much help. The more information I have on your work and accomplishments, the better job I can do in answering their questions. That is why I am continually asking for such complete and detailed reports.

In closing, let me say that we believe in your projects that are studying the ways to produce quality beef efficiently. We believe they have a very high priority in the field of research. In your work you are going to have to develop new research methods. We believe you can do it.

M. L. BAKER: Dr. Byerly likened our striving for new facts in research investigations to that of gold seekers traveling to a gold strike. I like that comparison. I believe the fact that we have been free to take different routes in reaching our objectives has resulted in much greater accomplishments than if some one had drawn our maps for us and told us how we must proceed.

I think we in the United States can be proud of the accomplishments of our Land-Grant Institutions. We must not become complacent because of these accomplishments. We must continue to furnish the new and better tools for making progress in the years ahead.

I am sure you all know Dr. Clark. Dr. Clark, will you summarize our meeting for us?

CONCLUSIONS

R. T. Clark

Mr. Chairman, Director Hawkins, visitors, guests and Technical Committeemen: I have been asked by your NC-1 Coordinator to say the things that have been left unsaid. Well, I may in part, but such a request leaves me with too much latitude, and you are looking forward to starting for home.

Before I express my thoughts relative to your work projects, I want to express our very real pleasure in having Bill Craft with us. I hope he will be an annual visitor to at least one or several of our conferences. I regret that budgetary circumstances prevented us from having Don Warren with us, for I had originally hoped that he, too, would be able to attend this joint meeting.

Regarding the current situation in our history, you will be interested to know that we have an increase of 13 per cent in beef cattle on feed over 1950-51. The actual increase is in excess of 245,000 head. Some of the estimated losses on beef cattle feeding operations that have been reliably reported to us range from $5 to $45 per head.

Now as to our program, I have been given at various times definitions of a coordinator - some worthy of repetition, some otherwise, but I rather liked the last one I received a few months ago. A coordinator is a man that can evoke voluntary cooperation on the part of the participants in this project. A study of the existing data in the three Regional Annual Reports fully bears out the voluntary cooperation which this project has received from the states. But Harry Gayden's remark a few minutes ago, wherein he stated that the sums of money so far requested and certainly allotted for this work with beef cattle are small, pitifully small, in relation to the importance of the beef cattle industry, is a statement that is sad to relate, yet true.

Let me quote some statistics on budget allocations that no one presumably can dispute, for they are taken from a very excellent and lucid presentation which Byron Shaw made before the House Subcommittee on Agricultural Appropriations, February 5, 1952.

All of this is encouraging when you think of how few chips we actually control in this "game". How much more we could produce and how much more rapid the output could be in research knowledge if our joint requests, Federal and State, were allowed to go through to actual budgeted amounts.

In recent months I have learned of the increasing interest on the part of industry in what we are doing. These men want to help us. In fact, they need our help. Let me mention one serious problem - dwarfism. I have repeatedly warned that this problem would soon be out in commercial herds. No question about it now. We continually are being apprised of serious situations as a result of this deleterious characteristic and now we have certain prominent registered herds that have solicited our help through the application of Dr. Gregory's profilometer or whatever means are devised to rid these herds of carriers.

Table I.

Expenditures for agricultural research by the United States Department of Agriculture and by State agricultural experiment stations during 12-year period from 1940-1951, comparative buying power in terms of 1935-39 dollars, and comparison with gross farm income.

Fiscal year ending June 30	Obligations by agencies of U.S. Department of Agriculture	Expenditures for research by State Experiment Stations		Total	Total research expenditures (Col.5) adjusted to buying-power of 1935-39 dollars	Total research expenditures (Col.5) per $100 of gross farm income
		Federal-grant funds	State funds			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Thous.dols.	Thous.dols.	Thous.dols.	Thous.dols.	Thous.dols.	Cents
1940	21,806	6,848	12,635	41,289	41,664	38.2
1941	21,127	6,862	13,206	41,195	41,113	30.1
1942	21,763	6,922	13,519	42,204	39,740	22.7
1943	22,433	6,871	13,954	43,258	39,361	18.9
1944	23,106	6,972	15,719	45,797	41,370	19.0
1945	23,308	6,990	17,343	47,641	42,766	18.8
1946	24,834	7,190	20,787	52,811	42,866	18.3
1947	31,143	7,197	27,700	66,040	44,712	19.2
1948	35,986	8,824	35,350	80,160	51,122	23.1
1949	43,060	10,604	40,305	93,969	56,269	29.4
1950	45,864	11,960	45,205	103,029	61,731	31.5
1951	43,118	12,558	50,972	106,648	60,219	28.7

Table II

Proportions of Federal and State included in Column 7, Table I

	Federal & State	Federal	State
1940	38.2¢	26.5¢	11.7¢
1950	31.5	17.7	13.8
1951	28.7	15.0	13.7

If we take the BAI's own support for beef cattle research, it figures out at approximately a little less than 1¢ per $100 of income derived from beef cattle.

Table III

Investment in principal fields of agricultural research by the U. S. Department of Agriculture and the State Agricultural Experiment Stations, fiscal year 1951.

(In Millions)

Utilization:	Amount
Crop products	$11.13
Animal products	4.72
Forest products	1.75
Total	$17.60
Marketing:	
Preparation	$3.77
Marketing systems	2.28
Expanding outlets	1.59
Market channels	1.19
Basic data	.31
Total	$9.14
Farm economics, engineering:	
Economics of production	$3.14
Household economics	.91
Rural life	
Housing	1.47
Farm machinery	1.65
Electricity	.37
Total	$7.54

Animal production:	Amount
Dairy	$6.50
Poultry	5.05
Beef	5.38
Sheep	1.74
Swine	2.89
Other	1.24
Total	$22.80
Plant production:	
Field crops	18.45
Horticultural crops	15.55
Forage pastures & ranges	
Forests and ranges	7.38
Farm forestry	
Total	$41.38
Soils:	
Improvement	5.95
Classification	1.71
Erosion	2.72
Total	$10.38
Grand Total	$108.84[1]

1 In order to reflect the total research program of the Department of Agriculture and the State agricultural experiment stations, this figure includes research funds of approximately $2,000,000 made available to the Department of Agriculture from outside sources.

In order to bring about a higher national input into beef cattle research from both the Federal and State levels, it is going to take as much real team work, apparently, as we have put into these projects up to this date.

We should be encouraged when a man like Dr. P. V. Cardon stated that he is convinced that this project was one of the finest examples he knew of illustrating the benefits to be derived from team effort in research. This can also be said - that no other set of regional projects has produced so many research publications.

But we woefully lack "hands" or personnel, both scientific and sub-professional, to do the job. In addition, we need the most modern equipment to do an efficient job of handling data and keeping up our liaison work. This equipment, some of it electronic, should be at hand and in adequate amount. On personnel we should not have to lose men like Dickerson, and if it is a question of money, we should be able to compete. The size of the cattle industry warrants that. If it is a question of the man's desire to come West, we should be able to hold him at Denver, for there is ample work there, as Bob Koch will testify, and Bob Carter, too, when his work gets rolling.

I believe that Dr. McPhee will agree that there are two principal kinds of limitations that we have to deal with in getting support for worthy projects, (1) Congressional and (2) Non-Congressional, and it will test the ingenuity of all of us to overcome these limitations. At this time I would like to express my very sincere thanks and appreciation to the two Regional Advisors, Marvel Baker and Dr. Patterson, for the continuing support that they have given to NC-1 and S-10 in committees of the Association of Directors and in other realms where opportunity was presented to put this work in its true perspective. In addition, they have been extremely helpful in getting our Technical Committees to function and particularly in bringing about a truly cohesive program between the Federal Government and the States. Having previously served in a State Experiment Station in an administrative capacity, I can appreciate perhaps more than anyone in the Federal unit what these men have contributed.

Finally, as you all know, I have had an opportunity this year in cooperation with one of the experiment stations in the Western Region, Hawaii, to take a long look back at this project, and while doing so have been engaged in project work with actual cattle producers who were real men, most of them well educated, all keen stockmen, intensely interested in research, and genuinely friendly. I think I know what the industry expects of us. If we are unable to get the job done, these men will do it themselves, but they naturally feel that in the first instance Federal and State agencies should perform the research for them, for that has been the usual approach in Agricultural Research in our country.

To have gone through this experience has taught me to realize how much "spinning of wheels" we have experienced in the immediate past and how much more rapidly we could progress, given a respectable degree of support and personnel to do the job. Therefore, I want all of you to continue to encourage top students to get into Animal Science work, for we need them and will use them.

And so in closing these remarks I want to thank all of you for the effort that you have put forth to make this work in beef cattle improvement a fine example of team work.

M. L. BAKER: Thank you, Dr. Clark.

L. E. HAWKINS: Let me say that our doors stand open to you men. It has been a pleasure to have had you folks here with us.

M. L. BAKER: I am sure that I speak for both groups when I state that we do appreciate the hospitality and facilities which you have extended to us. At this time I would like to introduce J. O. Grandstaff. Dr. Grandstaff, would you care to make a few remarks at this time?

J. O. GRANDSTAFF: I have found a warm welcome at this meeting and I appreciate your thoughtfulness. I have a great deal to learn about this work. My contact with you at this meeting has shown me that a lot of sincere effort is being put into beef breeding work and some worthwhile progress has already been made. As has been pointed out, we do need to be strengthened with funds and technical know-how in a number of our projects.

M. L. BAKER: This part of our meeting will adjourn. We will now meet in NC-1 and S-10 groups for our business meetings.

(Minutes of S-10 business meeting distributed earlier.)